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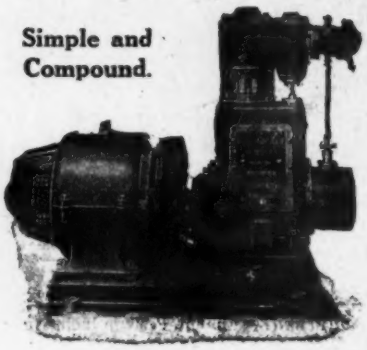

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TO "ELECTRICAL REVIEW" READERS.

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STRIKES.

ALTHOUGH the strikes which disturbed the London public a fortnight ago are now happily over, they are not "done with"; that similar crises will return can hardly be doubted—the millennium has not arrived—and it will be wise on the one hand to endeavour to remove the causes of such occurrences, and on the other to provide against them as far as possible. We do not question for a moment the right of men to withdraw their labour on due occasion; that is as indisputable as the corresponding right of men to continue at work should they think fit to do so, without interference. But we do protest against the tendency to strike without warning, without authority, and without adequate reason, which has been markedly observable in connection with recent disturbances, and against the cruelty of strikes of which the hardships are felt mainly by people who are entirely unconcerned with the questions at issue.

We therefore cordially welcome the step which has been taken by the Ministry of Labour, in inviting representatives of employers and employed, in many branches of industry, to a Joint Industrial Conference next week, for the purpose of discussing the situation and ascertaining by what means the feeling of unrest which prevails in various parts of the country can be allayed. It is interesting to note that the invitation is being addressed to Joint Industrial Councils and Reconstruction Committees, where they exist, and thus we see the principles of the Whitley Report bearing fruit in the organisation of this National Conference—which some day may take the shape of a Standing Council of representatives of employers and workers. The proposal to confer has met with general approval; while in some industries local organisations already exist which have proved their ability to settle all such questions amicably, it is, nevertheless, felt that much benefit may be derived from the national gathering, and that, at any rate, no harm is likely to be done by it. Of course, the conclusions arrived at can only be of a general nature, as the conditions of working vary so widely in different industries, that each case must be finally settled on its own merits by those most directly concerned.

Turning to the subject of the threatened attempt of the E.T.U. to plunge the Metropolitan district into darkness, several interesting points arise for notice. As we indicated in our last issue, a weaker case for a strike could hardly have been imagined; not only did it make no appeal whatever to popular sympathy—the first condition to be fulfilled before success can be hoped for—but it offered no inducement even to the members of the Union to leave their posts, a fatal error indeed, for the men whose services were concerned would have been loath to do so even for their own purposes; and, as the event proved, they flatly declined to do so for the sake of a political will-o'-the-wisp. The leaders of the London Branch, therefore, committed a

colossal mistake when they embarked upon this foolish policy, and not only brought the Electrical Trades Union into bad odour with the public, but also called down upon themselves the censure of their own members—not to mention the National Executive, which did not appear to cut much ice in the recent frost.

Now, what is the matter with the Electrical Trades Union? We think the answer has been most ably expressed in a letter from a Trade Unionist which appears in our "Correspondence" columns to-day. The facts are notorious. During the war the E.T.U. admitted to membership every Dick, Tom, and Harry that it could induce to enter, no matter how nebulous or remote his claims to electrical qualifications might be; it went further—it advertised itself as an efficient umbrella for those who wished to evade military service, and thus it became—what it is; we will not characterise it more closely, for the sake of the good men who also belong to it.

It is about those good men—by which we mean trained, highly-skilled electricians, men who take pride in their work and uphold the dignity of their calling—that we wish to speak. Are they content to remain lumped together with the war-shy, the alien, and the nondescript? to exercise the same voting power as the boys who belong to the same Union, and to further the political aims of a clique of Bolsheviks? We cannot think that that is their wish. But if they desire reform, it is for them to act—no one else can do it for them. We commend to their notice the proposal put forward by our correspondent—to form a branch of the E.T.U. as a Craftsman's Union, to which none shall be admitted but those who can prove their just right to that privilege. Why should not the Electrical Trades Union possess a standing and reputation on a par with those of other Unions that we could name? It is a matter for the members, and, if they care to take it up, we shall be pleased to provide space in our "Correspondence" columns for its discussion—but *short* letters, please!

Before leaving this subject we feel bound to refer to the letter of Mr. John Vincent, which appeared in our last issue, regarding the shorter working week. We wish to enter an emphatic protest against the fallacious doctrine that unemployment can be lessened by shortening the working hours in order to secure the employment of more workers. It is based upon the idea which for so long has obsessed the British worker, but which has been so often disproved by facts—that there is a fixed amount of work to be done. The effect of increasing the cost of production, however brought about, is inevitably to diminish the demand, the output, and the amount of employment; and unless the rate of production per man is increased sufficiently to counteract the reduction of the working hours, that result will surely follow. Hence the Unions which are out for a short working week are helping to bring about an increase of unemployment, either under an honest misunderstanding of the facts, or, as in the recent example, for purely political and anti-national motives. This is no time to increase the cost of production; what is urgently necessary is increased output at the lowest possible cost—failing that, ruin and misery, which invariably bear hardest on those least able to endure them.

Fuel Economy. Elsewhere in this issue will be found an article dealing with the coal consumption of power stations, which we specially commend to the attention of central station-engineers; the author (Mr. R. H. Parsons), an engineer of exceptional ability and resource, has himself employed the system which he describes in the working of a large power station, with results nothing short of remarkable.

In these days fuel economy is a matter of the first importance, and the station engineer cannot afford to ignore any device which is likely to facilitate the accurate determination of the true conditions under which his plant is working, or to reveal the nature and cause of losses known or unsuspected. In up-to-date undertakings a variety of instruments is provided, and numerous records are kept, with those ends in view, as we showed, for instance, in our recent article on the Sheffield Electricity Works; but observations and records, however voluminous and accurate, are of little value unless their meanings can readily be interpreted.

It is here that the value of the method outlined by Mr. Parsons makes itself felt. The simple law, closely analogous to the famous Willans law to which he draws attention, is the key by which the problems of the boiler house and engine room can be solved. With the aid of graphic methods, which appeal to the eye at once, a *constant check* is maintained on the rates of consumption of coal and water, and on the efficiency with which the plant is operated, and, at the same time, the invaluable incentive to improvement that is afforded by the cultivation of the spirit of emulation between the various shifts is fully utilised. As we have said, the method has been tried and found extremely effective, and it is in the hope that our readers will likewise profit by its adoption that we invite them to give it a serious trial.

The Battle of the Systems. The question whether the battle of the systems, which has been dormant for many years abroad, is about to be resumed, has been raised by Dr. von Dolivo-Dobrowolsky, in a paper read recently before the Electrotechnical Association in Berlin, in the course of which he predicts a return to the direct-current system for the electrical transmission of power over long distances. The author points out that the substitution of alternating current for the then customary direct current gave rise to the transmission of power approximately three decades ago; but, in his opinion, transmission by three-phase current has now reached the limit of its possibility of development. With overhead conductors the economic limit for alternating currents lies at about 240 miles and a pressure of 200,000 volts, but with cables the limit is 60 miles. It is necessary, however, to think of the future, when engineers will have to deal with distances of from 300 miles even up to 600 miles. Great reliability can only be obtained by the removal of the conductors from the air—that is, by the substitution of underground cables; and the author, therefore, recommended the reversion to high-pressure direct current for this purpose. This is considerably more favourable for cables, and the further development rests with the future. The author invited all German engineers to co-operate in the matter, so that the prospective great revolution in practice should have its origin in Germany, and be of advantage to the whole world.

In this country the conditions are different; we have no long transmission lines, and unless and until we seriously contemplate generation on the coal-field and transmission to the centres of consumption, we shall not even approach the 60-mile limit for underground cables suggested by the author. As a matter of fact, recent investigations arising out of the national electricity supply proposals indicate that it is not profitable to transmit electrical energy in this country more than 30 miles. Hence the three-phase system, which has secured almost a monopoly of what we call "long-distance" transmission here, will serve our pur-

pose for a long time to come, and it is rapidly growing in favour for distribution also.

We said "almost a monopoly," having in view the high-pressure direct-current system put down for the Metropolitan Electric Supply Co. some years ago by Mr. J. S. Highfield, which, we believe, is the only example of its kind of any consequence in this country. For Mr. Highfield's purpose the system offered certain advantages, and it would be interesting to know what progress has been made in its development and working.

We would, however, emphasise the fact that while this "tight little island" offers few opportunities for long-distance work, the British Empire abounds with them. The case of the Victoria Falls at once comes to mind, as one which aroused intense interest some 15 years ago; that problem still awaits a solution, but is only one of many similar ones on which the British engineer will soon, we hope, be engaged. The report of the Committee on Water Powers of the British Empire, which we summarised some months ago, contains particulars of numerous water powers of vast potentialities in remote localities—and the question relates almost wholly to water-power development. The subject, therefore, although of no immediate importance to us at home, has a very real interest to us in its bearing on the development of the natural resources of the Empire, as well as those of foreign countries; and while we do not attach much weight to Dr. Dolivo-Dobrowolsky's prediction, it behoves us to keep a close watch on progress in the technology of long-distance transmission in every school of engineering thought.

National Electricity Supply.

From the correspondence which has appeared in our pages, and the Memorandum of the Association of Consulting Engineers which we publish to-day, it will be seen that the report of the Committee appointed by the Institution of Electrical Engineers on the subject of electric power supply, to which we took exception in our issue of February 7th, is meeting with criticism in other quarters also. The Consulting Engineers fix upon the same point as ourselves—namely, that the Electricity Commissioners should be armed with wide and effective powers to act in an executive capacity, whereas the I.E.E. Committee proposes to limit them to advisory functions—a mere mockery of reform. It will be observed also that the Electrical Section of the Newcastle Chamber of Commerce, after discussing the subject, endorsed this view, and indeed it appears to be the general opinion; we shall not be surprised if the Provincial Centres of the Institution take the matter up.

We gladly seize upon the excuse put forward by Mr. C. H. Marshall, a member of Council of the I.E.E.—that the Committee, though appointed by the Council of the Institution, was not in fact, and was not meant to be, representative of the Institution of Electrical Engineers. It was a joint Committee representing some 14 engineering Associations, of which the I.E.E. was only one, and, as the Memorandum above-mentioned shows, the report of the Committee did not necessarily convey the views of any one Society correctly. This affords a loophole for the Institution, like the Association of Consulting Engineers, to escape through, and we hope that the matter will not be allowed to rest where it is. It would be most unfortunate if the report were to go forth as the verdict of the Institution as a whole.

The Trade Situation in Germany.

Herr Karl Friedrich von Siemens, chairman of the Siemens-Schuckert Works Co., is reported to have stated that it was necessary for the company to change over to peace work; but this operation was rendered difficult owing to the absence of willingness to work, and the lack of raw materials. Orders were not coming satisfactorily to hand; and foreign countries were withdrawing their orders, as they had no confidence that German works would be able to effect delivery under the prevailing labour disturbances. It was not possible for sale prices to keep pace with the increase in wages and in the cost of raw materials. The constant interruption in working through strikes, political demonstrations, and works' meetings had caused the average efficiency of the men to fall far below half the normal; whilst, on the other hand, higher wages per hour were being paid. The exclusion of the district on the left bank of the Rhine had had the result of causing it to be impossible to obtain supplies of many partly-finished materials.

The chairman of the Elektrizitäts A.G. (late Schuckert and Co.), of Nuremberg, addressing the shareholders at the recent annual meeting, stated that the year 1917-18 was comparatively favourable. On the other hand, the present situation was so unfavourable that the immediate future was looked to with anxiety. The hard terms of the Armistice had a paralysing effect on all undertakings, whilst the internal political and economic conditions were developing in a way injurious to industry. Operations in most departments at the Nuremberg works had had to be reduced to 34 hours per week, owing to the decrease in the working hours through the scarcity of coal, and the cancellation of war contracts which could be only partly replaced by peace orders and the very few orders received from the State. The strikes in Berlin, &c., had led to a fall in the output of the works by more than two-thirds of the normal, and wages and salaries and the prices of materials had considerably advanced. As a consequence of these circumstances and the internal conditions, the chairman remarked, the hope of regaining the export markets was vanishing.

Distributing Powers in London.

In the Report of the Municipalities of Greater London owning electricity undertakings, London has, for the first time, come under review in connection with the reorganisation of the Electricity Supply Industry. This Report, it will be remembered, dealt very largely with the political side of the question, the bias, needless to say, being in the direction of a thoroughgoing municipalisation. The chief point advocated was the establishment of an Electricity Board for Greater London, from which every company interest would be jealously excluded. In view of such a sweeping judgment, it might not be out of place to glance at the facts of the case from the point of view of the comparative interests of companies and municipalities respectively as they stand at the present moment. Thus, as regards areas over which municipalities and companies respectively have distributing powers, taking the area of Greater London as, say, 970 sq. miles, the municipalities hold distributing powers over 216 sq. miles and the companies over 402 sq. miles. It will be seen, therefore, that so far as Greater London is concerned, the company interests predominate very largely indeed. Further (and this is important, since the new schemes deal largely with the future), by far the greater part of the industrial area as yet undeveloped lies in the hands of the companies, this undeveloped area being situated in that outer belt of Greater London usually termed Extra-London. In this Extra-London area the municipal interests cover only 161 sq. miles, as compared with the company area of 338 sq. miles. The fact that the companies have almost a monopoly here has come about, apparently, through local authorities in the Home Counties having fought shy of municipal enterprise.

In the County of London itself, the difference is, of course, not nearly so great, but the preponderance is still on the companies' side, the respective areas being—municipal, 55½ sq. miles; company, 64½ sq. miles.

A review of these figures will show that, despite political convictions, when the question comes to be dealt with as a practical issue, consideration must necessarily be given to such obvious facts, and any scheme which ignores them cannot expect to be taken seriously.

A moral incidental to the London situation as given above is that each of the various big districts in England must be treated individually, and that conclusions drawn from a survey of England as a whole are often flagrantly misleading when applied to a particular district considered as a unit. Some districts are almost exclusively company, some municipal, and some—like London—hybrid.

THE COAL CONSUMPTION OF STEAM POWER PLANT.

By ROBERT H. PARSONS, M. Can. Soc. C.E.

As the cost of fuel is by far the largest single item of expense in the operation of a steam power station, the greatest factor in determining the cost of power production in any given station is the number of pounds of coal burnt per KW.-hour generated. This figure will depend, of course, very largely upon the nature and magnitude of the load upon the station, and upon the type of machinery installed, and to this extent it is beyond the immediate control of the engineer responsible for the management of the plant. But with any given load and equipment the coal consumption may vary between wide limits, according to the care taken in the operation and maintenance of the generating machinery. It is this "controllable margin" that deserves the most unremitting attention of the power plant manager, because the dominating influence of the coal bill on the generating costs makes the saving of even a small percentage of the fuel a matter of more practical importance than a corresponding saving on any other item of expenditure.

It is not the purpose of this article to discuss the various directions in which a saving of fuel may be brought about, but rather to direct the attention of engineers to a practical methob of keeping a check upon the efficient use of fuel shift dy shift, whatever may be the output during the shift.

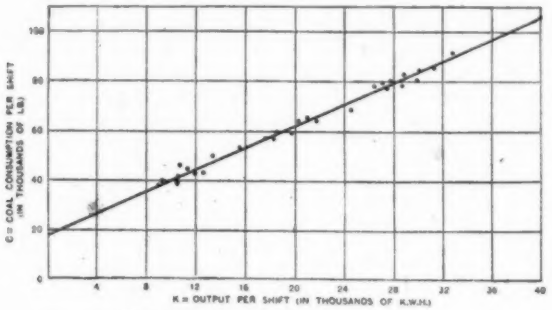

FIG. 1.—COAL-CONSUMPTION CHART.

Incidentally, also, the method advocated gives the engineer a far more comprehensive view of the working of his station considered as an organised unit than he can acquire from a study of the log sheets and other periodical returns of the working of the plant. But it is the feature of independence of output which gives the method its peculiar value. The bare figure of coal consumed per KW.-hour is apt to be misleading. It depends very much upon the output during the period in question, and with a good load a low operating efficiency may show an apparently better coal-consumption figure than a really higher operating efficiency under less favourable conditions of load. For example, a coal consumption of 2·75 lb. per KW.-hour for a shift output of 40,000 KW.-hours might be really a distinctly worse performance than a consumption of 3·0 lb. per KW.-hour for a shift output of 20,000 KW.-hours in the same station. Yet the average station engineer, if satisfied with the second of these figures, might possibly be as well, or better, satisfied with the first figure, because he would not know what consumption might reasonably be expected from his plant at various loads. What appears to be required is a system of criteria for the behaviour of individual plants under varying loads. The nature and equipment of every power station affect the coal consumption to such an extent that a direct comparison between the coal consumed per KW.-hour in different stations is misleading as a test of efficiency of operation. Such comparisons could be made with great advantage by comparing the criteria of individual plants here suggested; but they would bring out the relative merits of the different equipments rather than the relative efficiency of the operation of the stations. The primary object of the criterion of a station is to serve as a standard against which the results of that particular station may be judged, and thus to form a continual check upon the efficiency of operation. Having such a criterion for his station, the engineer would have no difficulty in determining at a glance which of the two coal-consumption figures in the example given above really constituted the better operating performance.

It was shown by the writer some years ago* that both the coal consumption and the steam consumption of a power station apparently followed straight-line laws. These figures represented the operating results of a large Canadian power station under his management, and the conclusions deduced from them have been found equally applicable to data obtained over considerable periods from central-station practice in this country. Having once determined the law of coal and steam consumption for a given power station, we have a criterion by which the efficient working of the station may be judged at the end of every shift, and any departure from the standard will not only be definitely brought under notice, but the cause, whether it is to be found in the boiler-room or the engine-room, will also be suggested with reasonable certainty. Thus any change in operating conditions, whether inadvertent or intentional, will be reflected at once, so far as it affects the economy of the station, and adverse conditions can be discovered and rectified with the least possible delay.

To determine the standard coal and steam consumption for a particular station is a matter of great simplicity. Referring, first, to coal consumption, a chart is prepared on squared paper, the vertical scale being figured in total pounds of coal burnt per shift, and the horizontal scale in total KW.-hours produced by the main generators. For the steam consumption per KW.-hour a similar chart is prepared, the vertical scale in this case representing pounds of feed-water pumped into the boilers per shift, and the horizontal scale total KW.-hours per shift as before. Having prepared these two charts, at the end of every shift the total coal and the total water consumed are plotted respectively over the figure representing the output on that shift. When a fair number of results have been plotted, it will be seen that the dots lie about a straight line on each chart, and

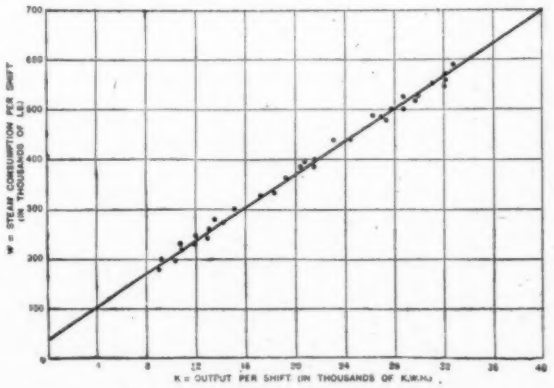

FIG. 2.—STEAM-CONSUMPTION CHART.

the line which lies most evenly among them must be drawn in. The easiest way to do this is to rule a line on a piece of tracing paper, and move it over the chart, when the best position of the line among the dots will readily appear. The appearance of the charts will be somewhat as shown in figs. 1 and 2. The greater the variation between the outputs of the shifts the more extended will be the series of plottings, and the more definitely, therefore, can the slope of the line be established. It will be found, however, that in the average station the difference in the outputs of the lightest and heaviest shifts of the day is quite enough to extend the plottings sufficiently, and the light Sunday load also provides points which assist in the location of the line.

* *Engineering*, November 14th, 1914.

Assuming the positions of the lines representing the total steam and coal consumption to have been determined in the manner described, the question arises as to what practical use can be made of them. The most obvious thing to do is to prepare a couple of new charts with the lines drawn upon them, and instruct the shift engineer to plot down on the chart so prepared the results of the working of each shift as soon as the figures are known. If any of the plottings come materially above the lines representing the standard figures, there is reason for inquiry, and the cause of the inefficiency may be investigated while the facts are fresh. The results of employing the charts in this way effected such a noticeable improvement in the efficiency of operation of one power station under the author's notice, that after a month it was found advisable to revise the standards and establish new and lower positions for the lines. Such a result would of itself justify the very small amount of trouble the method involves; but, apart from the check on overall efficiency of operation, the lines, when properly understood, throw a most valuable light upon the conditions obtaining in the plant.

Each line, of course, may be represented by a simple equation, which may be determined as follows:—Referring to fig. 1, let the coal consumption per shift be represented by C, and the output per shift by K. The value of C for any point on the line is obviously equal to the height at which the line cuts the vertical through 0, plus the additional height due to the slope of the line. The first of these quantities is read directly from the scale on the diagram—namely, 18,000 for this particular case. We also see from the diagram that when, for example, K = 40,000, the corresponding value for C is 106,000. Subtracting from this latter figure the constant of 18,000, we

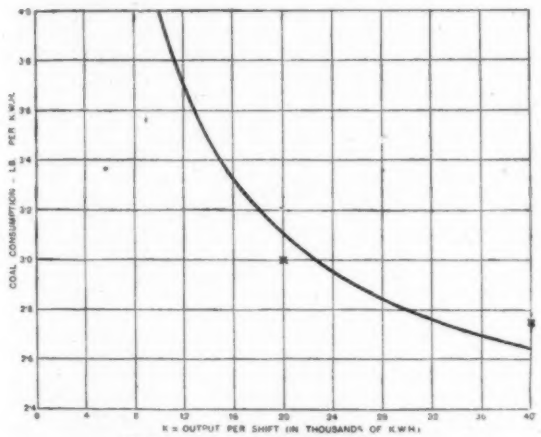

Fig. 3.—Coal-Efficiency Chart.

see that C increases in value by 88,000 for an increase of 40,000 in the value of K, or by 2·2 for every unit increase of K. The total value of C at any point is, therefore—

$$C = 18{,}000 + 2{\cdot}2\,K \quad \ldots \quad \ldots \quad (1)$$

This is the equation to the line in fig. 1, and gives the total coal consumption corresponding to any value of K, that is, to any output per shift. By treating fig. 2 in an exactly similar manner, we get another equation, namely—

$$W = 40{,}000 + 16{\cdot}5\,K \quad \ldots \quad \ldots \quad (2)$$

where W represents the total water consumption per shift, and K the total output as before.

These equations bring out certain very instructive facts relative to the operation of the station whose working they represent. In the first place, we see from equation 1 that 18,000 lb. of coal are burnt per shift without any corresponding production of energy, and that an extra 2·2 lb. are burned for every KW.-hour generated. The constant loss of 18,000 lb. represents the fuel used to supply all radiation, condensation, and other losses, and is substantially the same whatever the load on the station. It is, in fact, the "stand-by" coal necessary to maintain the station in working order at no load. Similarly, we see from equation 2 that 40,000 lb. of steam are used per shift without any corresponding output of energy, and that 16·5 lb. are used in addition for every KW.-hour produced. As before, the constant of 40,000 lb. represents stand-by losses, leakages, &c., and remains substantially the same whatever the output of the station. These substantially constant losses of coal and steam must, of course, in the nature of things, increase to some extent with the load; but what the plotted results indicate is that such increase is negligible in practice, and that no practical error arises from treating them as substantially constant.

Referring, again, to the two equations, namely—

$$C = 18{,}000 + 2{\cdot}2\,K, \quad \ldots \quad \ldots \quad (1)$$

and

$$W = 40{,}000 + 16{\cdot}5\,K, \quad \ldots \quad \ldots \quad (2)$$

if we multiply the first throughout by 16·5, and the second by 2·2 we have—

$$16{\cdot}5\,C = 297{,}000 + 36{\cdot}3\,K,$$

and

$$2{\cdot}2\,W = 88{,}000 + 36{\cdot}3\,K.$$

Subtracting the second of these from the first, we have—

$$16{\cdot}5\,C - 2{\cdot}2\,W = 209{,}000,$$

which may be written either as—

$$C = 12{,}666 + {\cdot}133\,W, \quad \ldots \quad \ldots \quad (3)$$

or as

$$W = 7{\cdot}5\,C - 95{,}000. \quad \ldots \quad \ldots \quad (4)$$

These two equations might also have been obtained directly from the coal and water consumption figures in a manner similar to that by which the former equations were derived.

From equation 3 we see that if no steam at all were to be used during a shift, 12,666 lb. of coal would, nevertheless, be required to maintain the boiler house conditions and to keep up steam. If this figure is compared with the quantity of 18,000 lb. of coal per shift found necessary to run the plant at no load, it will be seen that the difference between these quantities—namely, 5,334 lb. of coal per shift—is consumed in generating steam which is condensed through radiation, &c., and recovered as water.

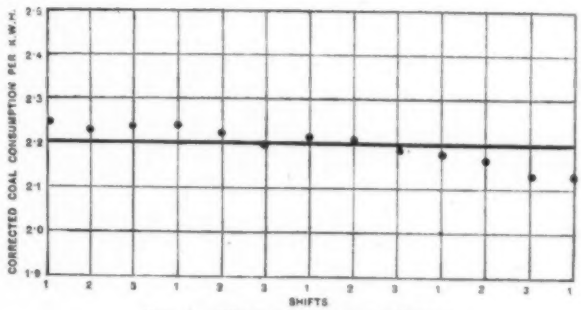

Fig. 4.—Water-Efficiency Chart.

Besides indicating the magnitude of the constant, or stand-by losses of the station in terms of coal and water consumed for the individual plant per shift, the equations further show that with the same type of station, and, therefore, for any other with equivalent efficiency of equipment and operation, any load which may be carried by the station can be generated for 2·2 lb. of coal, 16·5 lb. of steam per KW.-hour, and 7·5 lb. of water per lb. of coal, apart from the substantially constant stand-by consumption of coal and water.

From the same data, coal-efficiency and water-efficiency curves can be constructed (fig. 3), showing the consumption of coal and water per KW.-hour for any given output. These curves are obtained by dividing the total coal or water consumption per shift, as shown on the straight lines in figs. 1 and 2, by the corresponding output in KW.-hours, and plotting the points so determined. These curves show at a glance what coal and water consumptions are to be expected for any given output, and in addition enable performances at different outputs to be compared for their real, as contrasted with their apparent, efficiency. Take, for example, the question suggested at the beginning of this article, whether the consumption of 2·75 lb. of coal per KW.-hour for an output of 40,000 KW.-hours per shift was a better performance than a consumption of 3·0 lb. per KW.-hour for an output of 20,000 KW.-hours on the same

station. If the normal coal performance of the station in question has been found to be represented by equation 1, it will be seen from fig. 3 that the efficiency of operation was less at the higher load, and a consumption of only 2·65 lb. might have been expected. The assumed consumption figures are plotted in fig. 3 for comparison with the curve.

Charts prepared as described above enable a continuous check to be kept upon the gross coal and water consumptions of the station, but do not show directly any variations in the efficiency with which coal and water are used. This comparison can be made readily by a slight modification of the charts. Referring to the coal-consumption equation, it will be seen that for the plant in question the consumption per KW.-hour would be a constant quantity of 2·2 lb. per KW.-hour if there were no constant losses. The relative efficiency with which the plant is being operated at various times, can therefore be seen by comparing the variations in coal consumption per KW.-hour in excess of the constant quantity required for stand-by. To make this comparison, the constant loss, when once it has been determined for the station, is deducted from the total coal consumption per shift, and the resulting figure is divided by the output per shift, a constant figure of normal or standard coal consumption per KW.-hour being thus obtained. The chart on which the coal-consumption efficiency of the station is recorded will appear similar to fig. 4. The base line is divided to correspond with the successive shifts, and a horizontal line is drawn at a height corresponding to the normal or standard coal consumption of the station per KW.-hour; in the instance here assumed, 2·2 lb. per KW.-hour. As soon as the coal return for the shift is handed in, the constant quantity representing the stand-by losses is deducted, the result is divided by the output for that shift, and a point corresponding to the quotient is plotted on the chart. If the point lies above the horizontal line the operating efficiency is shown to have been below the standard for that shift, and vice versa; and the general trend of the line obtained by joining the plotted points will indicate the progressive efficiency of the station. An exactly similar method may, of course, be followed in respect of the steam consumption of the station; and by means of a comparison of the two charts a very good idea may be obtained of the respective improvements in the operation of the boiler house and engine room.

THE CHINESE MARKET FOR MACHINERY.

THE following is a summary of a report recently issued by the Far-Eastern Division of the Bureau of Commerce of the United States Government:—

The present situation in China as regards machinery is more a question of supply than of demand. China, emerging from internal dissensions, economically rejuvenated compared with the destruction of wealth going on in Europe, has found the usual sources of supply practically closed by the war. With silver worth more than ever known, the people would be anxious and willing to buy were not the same low exchange price in gold for their exports a deterrent. Everywhere abroad the home markets are being considered first; and if ships are found for what is left, it is carefully parcelled out.

New Lines of Manufacture.

The result of these conditions has been the industrial awakening of China and a determined effort to supply some needs at home, with the consequent expansion of Chinese domestic industries. The necessity that has driven the Chinese to look to home manufactures to replace imports no longer available has been the mother of invention in more lines than one, and hardly any field of manufacture has been left untouched or untried. Among the new ventures noted during 1917 are pumping, mining, and printing concerns, flour and rice mills, cotton weaving and silk filatures, oil and paper mills, brick and cement works, candle and soap factories, glassware and porcelain industries, electric lighting and water works, chemical manufactories, sugar refineries, and factories for making surgical instruments, heating apparatus, electric lamp bulbs, bicycles, imitation Panama hats, motors, printing presses, needles and nails, clocks, tiles, carpets, canvas, and leather ware. Many other factories have been started in a small way, and in every case there is the primary need of machinery.

Supplies Must be Financed.

Due to the lack of capital, the large majority of Chinese enterprises are of a joint nature, the Chinese supplying the working capital, and foreign interests supplying the fixed capital, in the form of machinery and supplies. It must be pointed out that in a great many instances original installations have been made at a loss with a view to getting the profits out of the venture from accessories, repairs, and renewals, as well as from an advertising standpoint, with the advantage of subsequent business elsewhere. As a rule, the Chinese wish to pay for a new installation out of the profits, and the dominant position of German machinery in China before the war was largely due to the fact that they always took part payment and extended the balance over a few years. Moreover, German firms carried small boilers, steam engines, ice-making plant, hand flour and rice mills, oil engines, dynamos, and machine tools in stock, which were installed and payment arranged later.

The sale of machinery is largely dependent upon the mode of financing such private enterprises, for, as has been pointed out, the lack of ready capital to cover initial purchases often leads to the machinery supplier being invited to participate in the enterprise. To those desiring to do business in this way the field is practically unlimited, just as the opportunities are very narrow for anyone expecting to do business on these lines as it is commonly transacted in the United States. Happily, the extension of adequate American industrial banking facilities is becoming more and more an established fact, and will serve as a valuable intermediary to those not desiring actual participation in the enterprises on the machinery for which they wish to bid.

Two Methods of Securing Contracts.

There have been two well-recognised methods of securing machinery contracts in China in the past. The first method is that of appointing one of the large mercantile houses having branches at all the important Chinese trade centres as general agents on a fixed agreement for a term of years. This was the system employed by almost all the large German manufacturers, and its principal advantage lies in the benefits accruing from an old-established connection on the ground with valuable Chinese connections. In addition to such agency, it has been found advisable to send one or more qualified engineers, trained at the home factory, who could use the offices and staff of the agents' branches in China on their trips of inspection, and co-operate with the agents' salesmen in obtaining business. The other and less desirable method for those just entering the Chinese field is to conduct the business direct with the Chinese and open offices at four or five of the trade centres with qualified engineers attached, who are competent not only to draw up specifications and quotations on the spot, but to carry on negotiations with Chinese officials and purchasers. There are, of course, any number of variations from these two general methods, but as a rule the first method is by far the more desirable for those new to the field, as the peculiar conditions of Chinese trade have nothing in common with conditions in this country, or in other foreign countries.

Shortage of Textile and Power Machinery.

In the course of analysis of the trend of the trade in China in various classes of machinery during recent years, the report points out that the decrease in the imports of textile machinery in no way denotes a backwardness in that industry. Owing to the fact that supplying countries were busy on war work, entries of this class of material showed a distinct drop in value in 1917 compared with 1915, and a still greater drop in quantity or weight. It is noteworthy, however, that Canada figured in 1917 as a furnisher of textile machinery to the value of about £40,000, whereas in 1915 her trade with China in that line was negligible. Judging by the unimportant influence on the importation of textile manufactures which has yet been exercised by the local industry, there is very great scope for the sale of spinning and weaving machines, and of the electric plant for driving them.

Inability to procure supplies accounts also for the drop in the sales of boilers, turbines, and other propelling machinery in the Chinese market, the total value entered in 1917 being less than half that in 1915, although Japan nearly doubled her sales in that line. Canada, too, sold such plant to the value of about £10,000, as compared with a mere £200 worth in 1915.

Larger Demand for Sundry Machinery and Machine Tools.

Imports of machinery for brewing, distilling, sugar refining, &c., are small, but increasing, whilst other new industries which have sprung up have involved an increase also in the value of the imports of machinery and parts "unclassified."

The total trade in machine tools has jumped almost 200 per cent. since 1916, and Japan's share has risen 300 per cent., that country taking not only its own share of the total increase, but practically all of the trade of Great Britain and France.

Demand for Electrical Materials and Fittings.

Under the heading electrical materials and fittings are included all accessories and appliances of an electrical nature. The use of these appliances is naturally limited to those cities and districts where electric power is obtainable, and the constant growth of this trade in these circumstances is promising. A great many electric power plants have been unable

to get machinery during past years to take care of natural increases in consumption, and new contracts for electricity have been subsequently refused. With an increased import of appliances under such circumstances we can only infer to what size the business would have grown under normal conditions. The import figures for electrical materials and fittings appeared in the ELECTRICAL REVIEW for January 17th, p. 78.

Japan Dominates Chinese Machinery Market.

Japan has taken a more and more dominant position in China's machinery trade each year. This is more readily seen from the totals of all classes of machinery imported, including machine tools, sewing machines, and electrical equipment, by countries, as given in the following table:—

Imports from—	1915. Haikwan taels.	1916. Haikwan taels.	1917. Haikwan taels.
Japan	1,720,189	3,721,456	5,043,924
United States	1,042,134	1,656,567	2,236,313
Great Britain	2,451,056	3,175,198	2,056,756
Hong-Kong	810,126	1,211,708	674,384
Canada	56,605	299,511	427,025
All other countries ...	977,988	159,730	490,097
Total gross imports ...	7,068,098	10,224,170	10,918,499
Re-exports	210,107	408,396	1,019,571
Net imports	6,857,991	9,815,774	9,898,928

N.B.—The Haikwan tael = 2s. 8d. in 1915, 3s. 2d. in 1916, 4s. 2d. in 1917.

Canadian Competition.

These figures show a consistent demand for industrial machinery and equipment in China which has been unaffected by scarcity of goods abroad, high prices, or lack of shipping, but, even taking into consideration the increased price of goods as affecting total values, has at least held its own in a time of considerable disturbance. Although Japan has increased its sales to a greater degree than America, this increase has been mainly in electrical fittings and equipment, supplies which China is rapidly making at home. The growth of Canada's trade in other classes has offset the losses of Great Britain, and Canada bids fair to become a serious competitor in the heavier lines. The report says that there should be nothing to prevent the United States not only from holding the advantage obtained, but, with increased supplies at home after the war, to gain an even greater share of China's machinery business.

New Antung Plant.

The electricity department of the South Manchuria Railway Co. expected to start up early this year the new plant, which has been under construction since July at Antung. This makes the third lighting and power plant operated by the South Manchuria Co. in the Antung district. While the new plant will remedy an insufficiency of electricity for lighting purposes it is intended primarily to furnish motive power for several new manufacturing enterprises, which it is expected will grow up in its immediate vicinity. The first of these will be the Anto Yoko Silk Mill. In addition a box factory and several smaller enterprises are being considered.

NATIONAL ELECTRICITY SUPPLY.

THE Special Committee, representing 14 engineering associations, which was appointed by the Institution of Electrical Engineers to consider the Board of Trade Report on Electric Power Supply, sent a letter to the President of the Board of Trade purporting to represent hose points on which the memoranda of the Associations were unanimous, but ignoring others on which they differed. (See ELEC. REV., January 24th, 1919.)

The Association of Consulting Engineers has therefore sent its memorandum to the Board of Trade, and doubtless other associations which do not find that their views have been fairly represented will take a similar course.

The Association of Consulting Engineers finds that the letter to the President of the Board of Trade directly conflicts with its support of conclusion 88a of the Board of Trade Report—that large additional powers should be given to the Commissioners; the Association recommended that the Commissioners should have as wide powers and discretion as possible. The Association also agrees with conclusion 88f of the Board of Trade Report, that the District Boards should be free to operate in any of the methods indicated. The following are extracts from the memorandum:

The Association welcomes the recommendations that qualified Commissioners should be appointed for long terms, and be independent of the political forces which have played such havoc with the industry in the past. They should take over from all Government Departments the work of framing rules and regulations, and it should be their duty to advise Parliament on all matters relating to the electrical industry. They should when necessary initiate legislation, and, in a word, their functions should be creative and not merely restrictive. Wide discretion should be left to the Commissioners, and they should not be too much tied by specific directions of detail.

The power companies need special consideration; their licences are not, as with lighting companies, for a term only, and if and when their generating stations and main transmission lines are taken away, their business will be extinguished, and the suggested purchase terms provide no compensation or allowance for goodwill. In the cases of local authorities and lighting companies, the business is not to be extinguished, and the goodwill, therefore, has not to be purchased. There should be included compensation to the extent needed if the business is damaged.

The Commissioners should be placed in a position to enable them to meet the Postmaster-General on equal terms in the matter of wayleaves. In the past serious obstruction has been caused by the power of the Post Office to obstruct other users of the highways.

The way of arriving at the price to be paid is apparently intended to get rid of the difficulty of valuing either on tramway terms or on the value of the business by simply taking the concern as it stands. The consequence of this will be that those concerns which have not put away depreciation, reserve funds, renewal funds, or sinking funds will be better treated than those which have made due provision, because the purchase price is to be what they have actually spent less what has, in fact, been provided. But the necessity for a valuation will still arise, because only part of the plant is to be acquired, namely, the generating stations, and presumably the main transmission lines, and the funds which have been provided (and which are to be deducted from the actual expenditure), are only to be those which can properly be allocated to the generating stations, so that some part of the reserve funds, &c., are to remain in respect of that part of the plant not purchased. There will therefore be the necessity for some kind of a valuation to determine the allocation of the reserve funds.

Although it is intended that the main transmission lines shall be acquired, the purchase clauses contain no recommendation as to the method of valuing these lines. If those recommendations are embodied in an Act, this omission should be remedied. Incidentally, it is doubted whether as a practical measure it will in all cases be feasible to separate the main transmission lines from the rest of the distribution system. In many cases the same series of ducts and the same manholes will be used for both main transmission and for distribution.

It is doubted whether Clause 57 would give the Commissioners sufficient power to deal quickly with a contumacious District Board. It would appear desirable that they should have some summary power, such as power to suspend or terminate a licence and take over the working of an undertaking if necessary.

Clause 70 does not provide adequate safeguards for the officials. Any official displaced by the operation of the scheme should have his claim for compensation adjudicated by the Electricity Commissioners, and if hardship be proved should have the right to equitable compensation.

At a meeting of the Electrical Section of Newcastle-upon-Tyne Chamber of Commerce on the 11th inst., Mr. H. W. CLOTHIER presiding, the subject of national electric power supply was discussed. It was resolved to disagree with the conclusions in paragraphs (G) and (H) of the letter addressed to the President of the Board of Trade on behalf of the Committee convened by the Institution of Electrical Engineers. The Section felt that the Electricity Commissioners should have executive powers as recommended in the report of the Committee appointed by the Board of Trade.

Mr. ELLIS reported upon the conference regarding the proposal to form an electrical federation in the district regarding the wages question, and it was resolved to call another conference at an early date.

The following resolution was passed by the Council of the I.M.E.A. at its meeting in London on Friday last week:—

"The I.M.E.A. view with great concern the suggestion which has been reported in the Press that the future control of electricity supply is to be taken out of the department of the Board of Trade, and to be placed under the proposed Ministry of Ways and Communications.

"Electricity supplies to collieries, factories, commercial users generally, and other consumers, preponderate largely over supplies to railways and to other undertakings coming under the control of the suggested Ministry of Ways and Communications, and it is feared that such control would be exercised in the interests of transportation, to the detriment of the larger interests involved in the general supply of electrical energy."

The secretary of the Association states that it has for some time been apparent that the report of the Board of Trade Electric Power Supply Committee, which has in its main principles been heartily supported by the I.M.E.A. and other progressive bodies, has not fully met the anticipations and desires of a section of the community particularly interested in electricity supply undertakings operated by companies, and it is very greatly feared that the proposal to take the matter out of the hands of the B.O.T. would result in making electricity supply subservient to other interests such as those of railways, and other forms of transport, and would further delay the putting into practice of the progressive movement in the national interests.

It is common knowledge that the B.O.T. has already proceeded with the preliminary arrangements to give effect to

the recommendations contained in its committee's report, and the Bill has been looked for for some little time past.

The Prime Minister has on several occasions referred to the reorganisation of electricity supply, and placed the same upon his Parliamentary programme for the earliest attention.

It is considered exceedingly regrettable, and it is feared significant, that the matter was not referred to in the King's Speech, unless it is deemed to be included under the reference to "a Bill to establish a Ministry of Ways and Communications, with a view to increasing and developing the industrial and agricultural resources of the country by improved means of transport."

In sending a copy of the resolution to members of the I.M.E.A., Mr. Proctor impresses upon them the view of the Council that the matter is most urgent and important, and asks them to immediately lay the same before their Electricity Supply Committees, and, if they deem it necessary, before their Councils, and to have resolutions passed in support of the same, and to take up the matter with their Members of Parliament, desiring them to take action in accordance with the resolution when the question comes before the House.

Mr. Bridgeman, for the B.O.T., said on Monday in the House of Commons that a Bill for the establishment of national super-power stations would be introduced at an early date. Consideration is being given to the question of ownership, but the question of coal prices could not be included in such a measure.

CORRESPONDENCE.

Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Re-employment of Engineers.

I have read with great interest your leading article in the ELECTRICAL REVIEW for January 24th, entitled "The Resettlement of Officers." But why officers alone, Mr. Editor? All the qualified electrical engineers, many of whom have, with "the long record of their brilliant and self-sacrificing achievements," covered themselves with glory, do not hold commissions in the Army, and, again, "As in the case of a private, so in the case of the officer—perhaps more so." (Why "more so"?) However, this is by the way. What I desire to state is that your remarks to the effect that the men, who have served their country well, in her direst hour of need, now that the strife is over and the cause is won, ask not for sympathy, but for a practical manifestation of gratitude, represent exactly the true sentiments of the men for whom you are kindly appealing. They call out across the sea for a job, not simply because they have served, but because they have served *and are qualified*. There are, of course, a few who apparently think, judging by some advertisements in the "Situations Wanted" columns, that by revealing the fact that they have been in the trenches, or have been wounded, &c., they will secure comfortable positions; but broad-minded men, who constitute the majority, do not maintain that the fact alone of having fought, and perhaps bled, qualifies a man for a position which he hitherto was incapable of holding.

Well, then, how can these overseas men obtain the jobs they seek? How will their cries be heard? The great difficulty confronting both officers and men overseas having demobilisation in view, with regard to their re-entry to civil employment is that, unlike the ordinary run of occupations, only few vacancies occur from time to time in the electrical profession, particularly in the central-station line. These are advertised each week in the columns of the ELECTRICAL REVIEW. But what prospects of success has a man "out here" who is desirous of obtaining one of these positions, and who cannot secure his release from the Forces unless he first obtains employment? If he makes application, the vacancies are probably filled before his application reaches England.

Therefore, Sir, I desire to appeal, through your paper, on behalf of the Engineer officers and men serving abroad to the principals of the various electricity undertakings at home, when vacancies are about to occur in their respective stations to glance down the "Situations Wanted" columns of the ELECTRICAL REVIEW each week to ascertain if there should happen to be a soldier electrical engineer with the necessary qualifications for the particular job vacant, and, if so, to give him the job, for this is the gratitude he desires.

Sapper Black, R.E.

B.E.F., France.

The Export Vision.

I was very much interested in reading your leading article of last week under the above heading. You say, "Where is the manager or director who will call the employés together and tell them the story of the World as it is to-day, in relation to the class of goods that they are daily making?"

Whilst claiming no particular virtue, nor any degree of honour and glory, other than a desire to improve the relationship between employers and employed in the sphere of my own particular business, I would just say that I have, for some time past, acted in accordance with the above suggestion of yours, and also in the spirit of other suggestions contained in your admirable article. I heartily endorse what you say, as I have found it to be most beneficial to all concerned, and I strongly recommend it to the attention of other employers.

Sentiment plays a large part in all business matters, and especially in regard to the promotion of good feeling, or the reverse, in any works. When a man knows not only what he is making, and what the machine is for, but also *where* it is going to, it makes a great difference to his mental attitude, and to the degree of interest which he takes in his work.

As a nation, we are woefully ignorant in the subject of geography, to say nothing of history, and when a man neither knows the position of himself, nor his own country, in relation to the rest of the world, either as regards "space" or "time," *i.e.*, geographically or historically, he has no vision whatever, except of himself and his own immediate surroundings. He becomes a self-centred and short-sighted individual, with very little power of judgment or perspective, and this disease (for it is nothing less) of "short-sightedness," is one of the principal complaints in the country at the present time, and especially so amongst what are spoken of as "the working classes."

We are principally an industrial or manufacturing nation, as is well known, and our prosperity depends chiefly upon our export of various commodities, but our ignorance regarding even the geography of the British Empire, to say nothing of foreign countries, is appalling, and there must be something radically wrong with our educational system in this respect.

If I might make a suggestion, I would recommend that a large-sized map of the world be placed in a conspicuous position in every workshop in the country. This map could be ornamented with flags, something like a war map, showing the various countries and places of the world to which the products of the workshop were sent. This might perhaps do something, if only a little, to cultivate or produce that "Vision of Export" for which you plead, and if this were amplified occasionally by "talks" from the manager, it would help to remedy that short-sighted mental condition, from which, at the present time especially, our nation is suffering.

Workmen will get their education somewhere, and their employers are the people best fitted for the purpose, and if some effort were made by them to educate their own employés and workmen in the simplest rudiments of political economy, and in particular as regards the export trade of this country, there would be far fewer strikes for a 30 or 40-hour week, such as have been exhibiting themselves recently. Everyone would realise that there never was a time, in the history of England, when there was so much work to do for all (at a reasonable price), and such great prosperity in store for us, if we could only "open our eyes" and "take the tide at its flood," which is, or should be, *now*.

J. E. Lea.

Manchester, *February 12th*, 1919.

The Future of the E.T.U.

Permit me to thank you for your admirable article in the current issue of the ELECTRICAL REVIEW on the abortive strike of the London District members of the trade on the 6th inst., and to express my agreement with the sentiments of your correspondent, my fellow "Member, E.T.U."

To my mind, it is high time that the great number of members of the E.T.U., who, like myself, are patriotic, and have a sense of responsibility to our fellow countrymen, should take action, and

(*a*) Exert pressure and purge the irresponsibles and extremists from the ranks of our union, or

(*b*) Secede from the E.T.U., and form a society where violent politics are excluded, and where we can exercise our energies in the legitimate aims and purposes of a trade union.

May I suggest to you, Sir, that you allow the columns of the REVIEW to be open for a reasonable period for further correspondence on this subject, so that something practical may ensue; you will not only earn the gratitude of the moderate men in the trade, but also "do the State some service."

Constitutional.

February 15th, 1919.

As an E.T.U. member on the negotiating committee for wages, &c., I must write and deprecate the action of certain E.T. Unionists writing to your paper on matters which should have primary discussion in their branches; but, lest the public be still further misled, an answer is certainly desirable to some of your correspondents.

Evidently, by his letter, "Member E.T.U." is not a member of a station branch, or he would be aware through that branch of the steps we took to secure the lighting and power supply of London until such time as our Society required the adoption of a drastic policy. Certainly at no station branch meeting held on the Friday were station men told they should have come out; instead, discussion ensued as to how

and why certain men had stopped work on the Thursday, especially as the notice in the Press referred to by your correspondent distinctly stated that station men were not to stop work that night. During our discussion it was found that certain men in outlying districts had stopped work, due to the fact that telephonic communication between us and our members had been stopped, and further, the powers that be had also seen fit to hold up nearly all the telegrams we sent off, and those which were delivered had in some cases had the wording altered so that a totally different impression was conveyed.

However, the reference to the sale of *Heralds* at meetings is a different matter. I think No. 3 Branch is the only station branch which has a policy of selling *Heralds* at its meetings, and as I am the individual responsible for their sale, I can assure your correspondent that there is no relationship between their sale and the propagation of Mr. Lansbury's particular views. Personally, I am quite aware that current events are just as much distorted to suit his point of view as they are also distorted by the Northcliffe Press, &c., for their particular objects—and here, let me say that the Press reports of the contemplated strike were only a series of distortions supplemented by some most extraordinary guesswork. But the one and only object for selling *Heralds* is to stimulate discussion and interest in current Labour topics at the branch meeting. The distribution of these *Heralds* has always caused me a certain amount of inconvenience, to avoid which on two occasions I gave up supplying them, and I have only re-started the sale at the urgent request of my fellow branch members, who are evidently convinced that, allowing for the biased opinions expressed in some articles, the paper is still a very interesting and instructive pennyworth from the trade unionist point of view.

With reference to "Shift Engineer's" concluding remarks, he had better not take that loyalty too much to heart, for I think the E.P.E.A., the N.A.S.E., also the A.E.C., claim to have the monopoly of that not much sought after spirit; all that we E.T.U. members insist on is loyalty—brotherhood we term it—to one another, but, Mr. Editor, should a drastic policy ever be decided on, rest assured that the station man will have his say and his vote on that policy, and, once decided on it, he will go ahead without any qualms of loyalty as suggested, and Mr. Farrar may then be lectured on the other side of the object-lesson he has so ably explained. But this policy, I hope, will only be adopted when all reasonable methods have failed to remove a genuine grievance, and I have too much faith in the intelligence of my fellow members to think they will be stampeded into any hopeless policy by what some of your contributors quote as the Bolshevik element. Let "E.T.U. Member" attend his branch and help to shape the future policy of his Society, and see to it that the appointed officials carry out that policy; then we shall have seen the last of the days when the daily Press can portray to a very gullible public how English trade unionists are being exploited through the agency of Russian and German gold.

J. J. M.

February 17th, 1919.

Recent events have placed the E.T.U., as far as the London Branch is concerned, in a very unfavourable light. Both the general public and the technical Press rightly denounced as dastardly its action in trying to put London in darkness, and looked upon it with contempt when it was found out that it was unable to do so, and that the whole thing was a bluff.

To come to the point: Are the members of the E.T.U. Bolsheviks? Emphatically no! The majority of the saner minded men were dead against coming out, and in a good many instances flatly refused. A number of the leading contracting firms tell me that some of their best workmen are members of the E.T.U., and my own experience confirms this. These men and others of the same class are highly indignant now that they find the strike was not called for their benefit, but that they have been made the tools of irresponsible sedition-mongers and led astray by a few undesirable aliens seeking power at their expense. The members realise that they have been badly let down by their "leaders," and at one branch meeting at least a resolution was passed calling upon the Executive to resign. The E.T.U., to put it very mildly, is out of favour both with the general public and with the trade. What is the cause, and what the remedy? The cause is not far to seek. It is that the E.T.U. does not represent any section of the electrical trade. It has a membership, I believe, of about 22,000, composed of wiremen, electricians, armature winders, mates, boys, and labourers. As everybody has a vote, and as the skilled men are in a minority, they do not get the representation they deserve. In a nutshell, they have gone in for quantity, and not quality. It has been said time and time again by men of experience that it is very galling and distasteful to have to work with men getting the same rate of wages and equal rights with perhaps two years in the trade. The remedy is in the hands of the members themselves, and they will never advance until they apply it. It is, to make their union a craftsman's union. Let the men who are good at their work and have served their time at it band themselves together, and let ability be the test of membership. Let them form a branch of their union as electrical workers—first-class men who know their job and take a pride in it. A greater self-respect and the good opinion of all concerned would be a foregone conclusion. This would lead to a desire for better conditions, and a willingness to deserve and earn them. Instead of holding meetings at public-houses and drinking thin beer they would have a place of their own with a useful library, where they could hold their meetings in comfort, and be better in body and mind for so doing. This is no figure of imagination; more than one set of men have been working on these lines for some time with highly successful results. From information which reaches me from various sources, I know that a number of the best men of the E.T.U. are in sympathy with these ideas, and would gladly see them put into practice. There is room for an independent man of good standing in the electrical world to give them a lead.

An Electrical Trade Union Worker.

[We refer to this matter in our leader to-day.—Eds. Elec. Rev.]

A Protective Association for Non-Technical Officials.

It is gratifying to see the interest manifested by such a large number of clerks in the question of organisation.

I regret that I gave the impression that all the clerks, including those in the electrical departments, engaged by the undertakings specified in my last letter, were members of the N.U.C. I sincerely hope that ere this they have become members. It appears to me that the correspondents are all agreed as to the need of a protective organisation, but not as to the type of organisation that will best serve their purpose. As an old trade unionist, I am strongly of the opinion that clerks, including non-technical officials, can only secure improved conditions by joining the National Union of Clerks, which caters for them.

The strength of the National Union of Clerks lies in the fact that it not only has Guilds for the special needs of a particular section, but that it unites all these sections into one cohesive body.

It must be obvious to every clerk that the conditions prevailing in one place must reflect upon the conditions in other offices. All clerks have a common aim, and must adopt an organisation which embraces all clerks if it is to perform its real functions,

In concluding, I appeal to all non-technical officials to let me know, through the columns of your valuable paper, whether they are prepared to attend a special conference if one is convened.

Power Company Clerk.

February 10th, 1919.

I have read with much interest the correspondence you have permitted on the subject of the organisation of the clerical and so-called non-technical staffs of electric supply undertakings.

It is perfectly clear that there is at present too much division in the camp; for example, take the position of a sales engineer who wishes to join an association: he has at present three different associations appealing to him, and none of these large enough to wield any real power. I confidently suggest *the only remedy is for each of these smaller Associations to become affiliated to the E.P.E.A.*, which has now obtained a large membership, and includes many chief engineers. *The E.P.E.A. can then hold a mandate for the whole of the salaried staffs of the electric supply undertakings*, and the beneficial results of this are easily foreseen.

It is to be hoped that the secretaries of the various associations referred to will immediately take steps to obtain the consent of the E.P.E.A. to affiliation. If this is done, and made generally known, I feel quite confident that the organisations will meet with unanimous support.

Accountant.

With further reference to my letter of February 7th last on the above subject, the following supplementary information may interest your readers:—

The Executive Committee of this Association, and that of the Chief Commercial Officers' Association, have for some time past given careful consideration to the question of closer affiliation between both Associations, and at a joint meeting of representatives of the two Executive Committees held on Monday last it was resolved to combine the two Associations into one organisation, which will in future be known as the Electricity Supply Commercial Association.

It is not possible to state the details of the amalgamation at this early stage, except that the Association is to form separate internal sections, in order to allow opportunity for independent discussion on matters relevant to a particular section only. Any further arrangements will be subject to the decision of an early meeting of a provisional national council representing members throughout Great Britain. This information will answer the many letters of inquiry that have already been received on the subject.

Your correspondents will also be pleased to know that, as a result of the information given in your issue of February 7th, applications for membership are pouring in wholesale from all parts of the country. Furthermore, the correspondence which now reaches me shows an earnest desire on be-

half of the clerical staffs of electricity supply undertakings to help us to the utmost in our aim. I am sure that the closing up of the ranks as indicated above will result in a further increase in membership in the near future.

Will all members, correspondents, and intending members please note that future correspondence should be addressed in the first instance to the Acting Hon. General Secretary, Electricity Supply Commercial Association, 39, Leghorn Road, Plumstead, London, S.E. 18.

G. R. Smith,
Acting Hon. General Sec.,
Electricity Supply Commercial Association.

London, S.E., *February 18th*, 1919.

I am very glad to see that things are beginning to move at last, and quite agree with "Supporter" when he suggests a Union to combine with the E.P.E.A. We do not want to read in the papers any more: "Owing to bad treatment on the part of the management, the switchboard engineers at the electricity works ceased work, but, thanks to the assistance of the clerical staff, their action was abortive, &c." To join forces with the E.P.E.A. would strengthen them, and make a strong combination; in fact, I am rather surprised the suggestion has not been made before officially by the E.P.E.A.

The interests of the clerical staff are absolutely wrapped up with those of the engineers, and on the success of the industry they both stand or fall together. It is obvious that the power-house clerical staff, many of whom have 10 to 20 years' specialised experience, are highly technical, and have not much in common with a clerk in, say, a grocer's shop (who, presumably, should join a grocers' union). I would also like to point to the Railway Clerks' Association, who prefer to work with the Railwaymen's Unions rather than the N.U.C., which is quite consistent, as their interests are bound up with those of the railwaymen. The N.U.C. is an excellent body, but not quite appropriate in this case.

Another Supporter.

February 17th, 1919.

The I.E.E. and National Electricity Supply.

The letters in your issue of February 7th from Mr. C. H. Marshall and Mr. Napier Prentice, apart from their bearing on the above important matter, touch upon another vital point, viz., the recently-acquired habit of Committees who, instead of reporting to those who appointed them, take important steps without sanction or discussion by the body of members of the Institutions or Associations in question, and by this means disenfranchise the main body of members.

In these days, when momentous decisions are being taken by the Government, we cannot allow even the Council of the I.E.E. (to say nothing of a sub-committee) to speak in the name of the electrical industry or profession until and unless the intended pronouncement is submitted to members for discussion. I hope steps will be taken by members of the Institution, and also of other Associations with which I am connected, to ensure democratic control of the actions of their committees.

In the meantime some influential action should be taken to acquaint the President of the Board of Trade with the situation, otherwise the effect of the Committee's letter to him may be to discourage the Board, and so deprive the country of a national electric power supply scheme approximating to that which the Board of Trade Committee recommended, and which the public expects.

W. Fennell, M.I.E.E.

Northwich, *February 11th*, 1919.

The Great Northern Telegraph Route.

My attention has been drawn to a note in your issue of February 14th about cable delays, in which this company's lines to the Far East are mentioned as passing Germany, and having been interrupted at the beginning of the war. This is not so. Our lines do not pass Germany—nor have we ever had any cable landed on German or other enemy territory—and they were working right up to the spring of last year, although with difficulties owing to the revolution in Russia. I should feel much obliged if you would cause this letter to be inserted in your next issue.

Paul Westergaard,
Great Northern Telegraph Co., Ltd.

London, E.C., *February 17th*, 1919.

[The statement referred to was published by the *Daily Telegraph* on the authority of the Eastern Telegraph Co.—Eds. Elec. Rev.]

Electrical Contracting.

Under this heading in this week's Review I see letters written by two men styling themselves "Amused" and "Live and Let Live" respectively. Methinks that behind those letters, which are, of course, not signed (my letters always are, and are open to honest criticism), there lies a motive other than the one of electrical advancement in the contracting line. Both these gentlemen, I fancy, have found the cap fitted them, apropos of the style of electrical work I mentioned in my first letter to the Review some weeks ago. I am sincerely sorry that they have taken the attitude adopted by them of attacking a man in the dark. I really thought, judging by the warm appreciation extended by you, Mr. Editor, in your first footnote, and which I have constantly received from those of high knowledge and experience mentioned by "Amused," that it would have led to something far better than the personal attacks of your two correspondents.

I alluded in my letters to the fact that rotten jobs had been put up in the past, and would be put up again also, unless some higher standard for electrical work, speaking generally, is adopted throughout the country. As practical contractors, both gentlemen must have come across too much of the class of work which I, for one, would like to see cut out altogether. What is there to prevent a plumber, or a gasfitter, at the present moment from putting in electrical work? I fancy the plumber must have put in some work I saw only last week, for it consisted of ordinary lead tubing with some lovely bends and sets in it, passing through a fairly large laundry; the cables inside the tube must, of course, have been there while the bending process was going on. I also saw a fair amount of lighting wiring carried out in water piping, including elbows, &c. I often wondered how the cables were taken to the different positions without seriously damaging their insulation. These two instances are only given as showing that our "profession" requires a slight lift up. Any electrical man who is knocking about on different jobs will tell you of the rotten work he comes across from time to time.

I am not seeking to cut out poor work as a cheap advertisement for myself personally. Most firms doing general contracting also carry out considerable electrical work, and employ fully qualified electricians at the highest rates of wages to undertake and carry out such work. There is, and will be in the near future, perhaps nearer than some people think, plenty of good-class work for those who want to cater for that class of work. I have heard it mentioned that some day "price-cutting estimating" may be entirely abolished, and instead, the work be given out on specification, a working percentage being allowed to carry out the work. The customer would be the gainer by such a system, and it would stop a lot of the throat-cutting existing at the present time.

I don't agree with "Amused" that the "labour" is to blame always for bad work, and not the material. If a good workman is given, say, tubing to set and bend which was never intended to be used other than in straight lengths, I fail to see how he can make a job of it. Yet I have seen the workmen blamed under these circumstances. On the other hand, I have seen a workman try to bury a conduit sunk box in a lath and plaster wall, and the tubing with it; perhaps his boss wished he had been buried with it! Such work has in many cases resulted in the firm in question losing repeat orders. If "Amused" has been bitten by this class of man I sympathise with him.

In conclusion, I fail to see where the attempt to curry favour in some unknown quarter comes in, as mentioned by "Amused." I took up the matter fully knowing what I wrote to be positive facts, with the hope that someone else more worthy than myself might be able to carry the point a little further than I could, and ultimately something tangible might be set up whereby a higher standard of electrical wiring might be attained. Considering the adverse criticism of the letter I wrote, it would be quite a treat if I could see one written by someone who, like myself, has no ulterior motive, but has his heart and soul in the electrical trade, no matter whether it be contracting or carrying out plant maintenance. Thanking you for the appreciation you showed me, and which I regret no one else so far has shown, I wonder if jealousy has anything to do with it? Personally, I sincerely hope such is not the case.

H. Fowler.

Liverpool, *February 17th*, 1919.

[This correspondence is now closed.—Eds. Elec. Rev.]

Engineer Surveyors' Salaries.

Referring to "Pitman's" letter in your issue of the 14th inst., after quoting a few dividends paid to the shareholders of certain insurance companies, he states that the figures in question were circulated by the Engineer Surveyors' Association a few months ago.

As the statement, to put it mildly, is inaccurate, I am directed by the Executive of the Engineer Surveyors' Association to say that no such figures have ever been issued, or authorised, by themselves, and they know nothing about the calculation referred to. I may add, however, that a private paper read last year by one of our members contained somewhat similar information re dividends. On being brought to the notice of the Executive, the figures were considered to be misleading, and consequently were not reproduced.

"Pitman's" further remarks regarding registering the Association as a trade union, &c., do not call for any special comment, as all members are cognisant of the actual position of affairs, and consequently know what value to place on the various statements made.

F. Trapnell,
General Sec., The Engineer Surveyors' Assn.

Manchester, *February 17th*, 1919.

Import Restrictions.

We understand that the policy to be adopted in regard to the continuation of restrictions on imports is receiving the consideration of the War Cabinet. The Federation desires to press most strongly on the Government the absolute necessity of not allowing products which compete with those of any industry in this country to be imported and sold at prices with which existing conditions make it impossible for the home industry to compete, until that industry has had a reasonable opportunity of converting from a war to a peace footing. Unless this course is adopted, the resumption of normal industrial activity in this country will be gravely prejudiced, and the effect upon employment must be most serious in the present condition of industrial unrest.

The Federation realises that pressure may be being brought to bear upon the British Government by foreign Governments who desire to import into this country, but such considerations appear to it to be infinitely less important than those to which reference has been made above.

In any case, it would urge that no relaxation of import restrictions should be made in deference to the representations of a foreign Government without securing from that Government a substantial *quid pro quo*, and that in any such case the relative value of the concession which is being made to the foreign Government and of the benefit to be received in return should be most carefully weighed.

Finally, I am to urge that no decision should be taken on this most important question without the fullest consultation with representatives of the industry of the country, and to say that we shall be most willing to place our organisation at the service of the Government to advise them, should they so desire. I am to point out, further, that the decision of the questions which arise in connection with the raising of restrictions and granting of licences often involves very minute inquiries into the available and potential supplies of small articles. These inquiries can most satisfactorily be made through an organisation such as ours, which comprises manufacturers in every branch of industry, and has collected very full statistics as to the products of the various industries, and we have already been able to render considerable assistance to the Government in dealing with questions of this kind referred to us by the Department of Import Restrictions.

V. Caillard,
President, Federation of British Industries.

London, S.W., *February 17th*, 1919.

"State Salary Expected."

I agree absolutely with "Applicant." Why is it? Because, like the Jew, whom it is so fashionable to despise, those advertisers have an innate dread of stating the amount lest they might be offering a little more than the applicant might have asked. There may be strong disagreement with my remarks, but I say openly that my varied experience has taught me that the average British employer in his own country is *not* straight. He prefers to equivocate rather than to define. Men of our race abroad, whether represented by the American or others, *say* what a job is worth *first*, and then see that they get a man who is worth it. Here they don't, but angle for brains; delude a man, if possible, into their service, then dole out remuneration with an unhealthy satisfaction that they have cheated somebody.

Disgusted.

Hundreds of technical men will surely be in sympathy with your correspondent "Applicant" on that absurd clause which appears in so many advertisements: "state salary." Any man answering such an advertisement is naturally tempted to suggest a higher figure than he would really accept, and consequently the job must often go to an inferior individual, or one who, by underestimating his own value, is really acting against the interests of the profession.

As your correspondent points out, the advertisers know what sort of man they want, and how much they are prepared to pay him, at any rate within a few pounds. If they cannot state a definite figure, I should like to suggest adopting an indefinite statement such as, for example, £250-£280, or, say, £270 approximately. This would clearly indicate to the applicant whether it was worth his while to apply for the post, and would save the advertisers the trouble of reading through numbers of unsuitable applications.

Interested.

February 16th, 1919.

I support "Applicant" on the above subject. How would employers care to tender for contracts on such vague information? Employers ought to know what the situation is worth, also what they are prepared to pay, &c. I believe most applicants apply for situations and accept them with the hope of advancement, but "there's many a slip." If men are caught gambling with pennies the law inflicts a heavy fine, and it is far worse to gamble with one's home, and it is a scandal to encourage it. Unfortunately, this scandal is spreading.

Anti-Cheapness.

February 14th, 1919.

I fully agree with "Applicant" that if employers advertising situations vacant would state the salary they are willing to pay, it would save a number of men from wasting time on applications for unsuitable jobs. If, as is suggested, employers are out for the cheapest man they can get, it would appear to be useless for a man requiring a fair wage to answer those advertisements which say "state salary expected."

I should also like to point out to employers that a considerable number of men applying for situations desire, if possible, to obtain work in a certain district, and it would save these men a lot of time and trouble if advertisers would state *where* the vacancy is situated.

C. A. B.

February 17th, 1919.

[This correspondence is now closed.—Eds. Elec. Rev.]

The Shorter Working Week.

I shall be greatly obliged if you can publish the following solution for the "six eight-hour shift week" in your "Correspondence" Column.

	Weeks.							
	1st.		2nd.		3rd.		4th	
Monday	N	...	E	...	D	...	Off	
Tuesday	N	...	E	...	D	...	S.D.	
Wednesday...	N	...	E	...	D	...	S.D.	
Thursday ...	N	...	Off	...	D	...	E	
Friday.....	N	...	E	...	D	...	S.D.	
Saturday ...	N	...	E 12 hrs.	...	Off	...	D 12 hrs.	
Sunday	Off	...	E	...	Off	...	N	

N = night shift; E = evening; D = day; S.D. = spare duty (for which I suggest efficiency tests of plant, plant repairs, and meter testing and repairing).

It will be seen that by working 12-hour Sunday shifts, every other week-end can be taken off, or one in four off if eight hours are worked, when the D and relief man could arrange days off to suit the locality.

It will be noticed that two good week-ends are obtained, N finishing on Saturday morning and resuming on Monday afternoon, while D finishes on Friday (four hours earlier if 47-hour week), and becomes S.D. on Tuesday. It also has the advantage that the relief man automatically drops into the night shift for the fifth week.

Shift Engineer.

February 17th, 1919.

Electrified Seed.

Dr. Mercier is too late! I married the sailor's mother who was sceptical about the flying-fish, but who thought it might be true that a wheel of Pharaoh's chariot had been found in the Red Sea. She never told me anything about "mountains of sugar and rivers of rum," and I shall be grateful to Dr. Mercier for a reference to the author of the phrase. As a *quid pro quo* I offer him a slight correction.

I do not believe that the "electrified chickens" (between inverted commas) which I saw were improved by being electrified, as they were treated so much better in many ways than ordinary chickens that a proper test, with the necessary control experiments, proved that electricity was not required; and, unless Dr. Mercier has himself carried out proper trials—not merely causing "great pleasure to Mr. Fry and his friends" by being able to visit several farms and inspect the crops grown from electrified seed on the eve of last harvest"—I shall incline to the belief that Dr. Mercier has been mistaken for once in his life.

Washing seeds in artificial fertilisers—as you, Sir, have already pointed out—may do a lot of good; and, if the effect of washing and drying seeds is to make them lighter, it is evident that by planting *the same weight per acre* of treated and untreated seeds, there is no mystery about the "electrification" which enables somebody "to pocket the money and do it again." Has Dr. Mercier seen the banking accounts to which he alludes?

Wide Awake.

February 15th, 1919.

[Several letters are unavoidably held over.—Eds. Elec. Rev.]

Munitions Plant Sale.—The *Times* states that a five days' sale has been concluded at Birmingham of the engineering plant and machinery at the National Shell Factory. There were 1,564 lots; electric motors realised prices exceeding their original price, and time-recording machines made double their cost.

LEGAL.

Re Armorduct Manufacturing Co., Ltd.

In the Chancery Division, on February 13th, the affairs of the Armorduct Manufacturing Co., manufacturers of electric cables and accessories, were before Mr. Justice Younger, under the Trading with the Enemy Acts, the Controller of the company appointed by the Board of Trade asking for the directions of the Court as to how he was to deal with the assets of the company remaining in his hands, more particularly in respect of claims by the former managing director and secretary of the company.

Mr. J. T. Matthew, K.C., for the Controller, said early in the year 1907 the company entered into an agrement with Mr. Wm. Ratcliffe Small, by which he was to receive as managing director a salary of £500 a year, together with 20 per cent. of the net profits of the company, the agreement being subject to 12 calendar months' notice. In the event of the company giving the notice, they were to pay the £500 immediately, and in the case of Mr. Small giving notice, the company had the right to require him to leave at once on payment of £500 to him. In respect of his salary, Mr. Small was to have a preferential claim over the company's assets. At a meeting of the directors of the company held on December 5th, 1907, Mr. Small's salary was increased to £750 and his share of the profits increased from 20 to 25 per cent. He was to have sole control and management of the business of the company, but he was free to engage in any other business which did not interfere with the business of this company. Subsequently, an agreement was entered into for 10 years, by which Mr. Small was to receive £1,200 per annum salary during the present war, to be increased to £1,500 per annum upon the signing of peace between Great Britain and Germany.

On January 7th, 1917, Mr. Small wrote to the Controller, saying the Board of Trade had notified him that the business was to be wound up immediately. The Controller replied relieving Mr. Small of his position at his own request, and saying that he (the Controller) would be glad to avail himself of Mr. Small's offer of assistance in respect of Government contracts then on the books of the company. At a meeting of the company, at which, it was alleged, there were no independent shareholders present, a special resolution was carried awarding to Mr. Small £3,000 for special services rendered to the company. It was in respect of this amount which had been credited to Mr. Small in his account with the company, together with his claim for £1,200 for one year's salary, that the Controller now asked for directions.

Mr. Schiller, K.C., for the respondent, Mr. Small, read an affidavit by his client, in which he claimed he was entitled to the sum of £3,000, based upon the profits of the company for the past three years.

Mr. Matthew said that was exactly the position. It had been suggested that some compromise might be arrived at, subject to his Lordship's approval.

His Lordship said, on the evidence before him, he conceived Mr. Schiller would say that the meeting at which the £3,000 was voted was a properly-constituted meeting of shareholders. Everything turned upon the validity of the resolutions, which it was said were carried by the votes of the person who was to ultimately benefit.

His Lordship ordered the summons to be amended by raising the point asking that Mr. Small be ordered to pay to the company the sum of £3,000 alleged to have been wrongly credited to him in the account as between him and the company.

British Westinghouse Electric and Manufacturing Co., Ld.

Mr. Justice Astbury, in the Chancery Division, on Feb. 18th, heard a petition by Mr. H. G. Wright on behalf of this company, asking sanction to the alteration of the articles of association.

Mr. Wright, in support of the petition, said the company was an electrical company carrying on a fairly large business. Its present capital was divided into 685,000 preference shares of £2 each, all of which had been issued and fully paid, 75,000 ordinary shares of £1, none of which had been issued, and 500,000 deferred shares of 1s. each, the whole of which had been issued and fully paid. The last class of shares were all held by one person, and were really issued for voting on a certain particular. The object of the company was to carry out an agreement between the Westinghouse Electrical and Manufacturing Co., a company constituted under the laws of the State of Pennsylvania, on the one part, and the petitioning company of the other part, and to carry on the business of electricians, engineers, makers and suppliers and dealers in electricity works, power, and light. The main object of the company, said counsel, was the promotion of subsidiary companies, and it was proposed to insert a clause in the memorandum of association as follows:—"To promote and reorganise any company, whether British, Indian, Colonial, or foreign, for the purpose of acquiring undertakings of such companies, or for carrying on any business which the petitioning company was authorised to carry on, or in furtherance of any of the objects of the company. Further, to underwrite the shares, debenture stock, or other securities issued by such company, and to guarantee the payment of the capital and interest of any such shares, debentures, or other securities, or the payment of the minimum rate of dividend on such shares, and generally to guarantee the performance of any contract entered into by any such company."

Counsel read evidence which went to show that the desired alteration of the company had been brought about by the present state of electrical business, due in a great measure to the removal of German competition. They asked for extended powers to develop their business in the United Kingdom and in other parts of the world, and, with this object in view, they desired to improve the method of conducting their business, and to subsidise companies. They were not really in a sense extending their business, but improving their methods and subsidising companies, in all of which they were going to hold shares.

Mr. Justice Astbury drew attention to the fact that there was a large debenture issue.

Mr. Wright said the company had issued mortgage debenture stock for £1,241,353 4 per cents., and also prior lien debentures for £250,000, bearing interest at the rate of 6 per cent.

His Lordship asked whether it was usual to act on a petition of this kind when the debenture-holders were not represented?

Mr. Wright said that the debenture-holders had all received due notice of the application, and he took their non-objection as an assent to the proposal.

His Lordship: The debenture-holders are as large as the shareholders?

Mr. Wright admitted that that was so; but he reminded his Lordship that the company was not taking extended powers but merely asking for a change in the methods of carrying on the old business.

His Lordship: Very well; you may take your order.

BUSINESS NOTES.

Our Letters from the Forces.—A demobilised central station official writes:—

"I have just succeeded in getting demobilised, and wish to take this opportunity of once again thanking you very heartily for your continued kindness in sending me the Review. I always eagerly looked out for it, and could be certain of finding plenty to interest and instruct me in the various articles, letters, news items, &c. After I had done with it there was always a crowd waiting to borrow it, and we had many pleasant little discussions regarding the different opinions expressed therein. I almost wonder which my late 'pals' will miss most, the Electrical Review or myself. I might say that during the whole time you have been sending (nearly two years) I have never missed a single number."

A major, well known in the electrical industry, in the course of an interesting letter, refers very gratefully to the Electrical Review for forming a link with home for so long. "The Review has followed me to France, Belgium, India, Mesopotamia, and Persia during the past 4½ years. It has reached me in many remote spots, even travelling by aeroplane post from Mesopotamia to Persia. At times when I have seemed most out of touch with the world in general, it has served to recall many of my visits to Ludgate Hill in the pre-war days, and helped to conjure up many visions of electrical progress during the after-war period."

Two Lead Market Reports.—Messrs. James Forster and Co., London, E.C., report under date February 15th:—

There are no buyers of forward lead, and on the Metal Exchange no offers have been made either of prompt or forward lead during the week. The official price for controlled lead remains at £30 per ton net.

The American market is again lower at 5 cents per lb., which would be about the equivalent of £25 per ton here. American lead (uncontrolled) is offering at about £29 10s. net, and a little business has been done at this for prompt delivery. So long as present conditions continue this market will remain practically dormant.

With round about 100,000 tons in stock here, large stocks in the hands of producers in Australia, America, and Spain, there is no room for any other policy on the part of consumers than that of buying from hand to mouth. A cut in prices of several pounds a ton would not, we think, induce free buying.

The Government will have to take the matter in hand without delay, as the present tactics will leave the stock on their hands indefinitely. Possibly the trade might be induced to take over all the stock at pre-war rates with the necessary credit facilities granted by the Government, but, even so, such an undertaking would be most onerous.

Messrs. G. Cawson & Co., London, E.C., report under the same date:—

There is very little fresh to report with regard to lead; the market during the week has been practically stagnant, and not a single transaction has taken place on the Metal Exchange. Prices are nominally unchanged—the control price is still at £30, with very little doing, except in small lots to cover pressing requirements. February shipment lead is on offer at £28 10s., at which America is willing to sell. Sellers of forward shipment have tried in vain to sell, but without success.

The imports last month are given as 25,150 tons, and as the Government stocks in the same period increased by 23,641 tons it appears that only about 1,500 tons went into consumption here, or were exported. Arrivals so far this month have again been fairly heavy, so that stocks here have probably increased by further 8,000 to 10,000 tons.

The Control make no sign of meeting the position, and doing their best to encourage trade—we wonder how long this position is to continue, and when those in authority will see the necessity of bringing about a more satisfactory state of things. It is perfectly clear to every one with experience in the lead trade that no consumer will buy at present prices unless compelled to do so from actual necessity.

While there is a stock of 120,000 to 130,000 tons overhanging the market, we can only look for a dull sagging trade, unless steps are taken to bring down the price to a more satisfactory level.

The English Electric Co., Ltd.—This company, which has now gone to allotment, has been formed to consolidate under one direction and management the various interests of the following companies, in all of which a predominating control exists: Coventry Ordnance Works, Ltd.; Dick, Kerr & Co., Ltd.; Phœnix Dynamo Manufacturing Co., Ltd.; United Electric Car Co., Ltd.; Willans and Robinson, Ltd. It is the intention to interfere as little as possible with the internal organisation of the respective

works, but the English Electric Co. will take over the whole of the external business management, and with certain exceptions, such as the civil engineering and contracting department of Dick, Kerr and certain special products of the Coventry works, will conduct all selling and other negotiations with the public. It will be remembered that the company, having arranged to acquire the whole holding of preference and ordinary shares in the Coventry Ordnance Works, Ltd., and the Phœnix Dynamo Manufacturing Co., Ltd., made an offer to Dick, Kerr shareholders to exchange shares on certain terms. It is now announced that about 90 per cent. of the Dick, Kerr shareholders have accepted the offer. The English Electric Co., Ltd., will control directly or through Dick, Kerr & Co., Ltd., the following powerful group of manufacturing interests, viz.: the Coventry Ordnance Works, Ltd.; Dick, Kerr & Co., Ltd.; Phœnix Dynamo Manufacturing Co., Ltd.; the United Electric Car Co., Ltd., and Willans & Robinson, Ltd. The company is registered with a capital of £5,000,000 in 1,500,000 £1 preference and 3,500,000 £1 ordinary shares, and the issued capital on allotment is just under £2,000,000.

Tour of Brazilian Delegates in Great Britain.—With the object of strengthening the business and personal relations between Great Britain and Brazil, the Federation of British Industries has invited to this country a delegation of representative Brazilian business men. It will be remembered that the Federation was responsible for the visit of a body of Greek commercial men to the United Kingdom in the autumn of last year.

Various reasons have influenced the Federation to select Brazil in the first instance from among the Latin-American republics. Brazil's area alone, covering more than half South America, entitles her to this preference, apart from the moral influence exercised in that continent by her wholehearted challenge to Germany at an early and critical stage of the war. The time is propitious for inaugurating a business tour.

With a view to considering the representative industries of both countries which will best profit by the tour, it has been decided that Mr. W. S. Barclay, who was loaned by the Federation to Sir Maurice de Bunsen's Mission to South America during last summer, shall proceed to Brazil and spend a few weeks there before conducting the delegates to this country. It has also been arranged, by courtesy of the Department of Overseas Trade, that Mr. Hambloch, H.M. Commercial Attaché in Brazil, shall accompany the party to this country and throughout their tour, a fact which will be of very great advantage to the delegates. Mr. Barclay will sail for Brazil on April 5th, and will arrange for the tour to begin in this country not later than June 15th.

Electricity Supply Undertakings and Priority Certificates.—In order that electrical undertakings with plant and machinery, &c., in course of manufacture under orders placed with Priority Certificates may understand the Priority of Work (Partial Suspension) Order, 1919, issued by the Minister of Munitions on February 7th, 1919, the following explanation has been issued:—

Outstanding Priority Certificates and Permits will continue to be effective until February 28th, 1919, but from March 1st onwards they will be inoperative unless special directions or regulations are issued in writing by the Ministry of Munitions.

Electrical undertakings with orders still awaiting completion, for which they hold Priority Certificates at the moment, should, therefore, take steps to ascertain from the manufacturers whether the withdrawal of the certificates on February 28th, 1919, will result in delay in the completion of urgently needed plant, machinery, &c. Should such delay be serious and prejudicial to urgently needed supplies of current by consumers, application may be made to the Priority Department of the Ministry of Munitions for the issue of a new Priority Certificate.

Orders placed from March 1st, 1919, onwards can be placed without Priority Certificates, but if deliveries cannot be secured in time, application may be made to the Priority Department for a Certificate, which will be issued if after inquiry it is deemed to be essential in the national interest that priority be given. All communications should be addressed to the Controller, Priority Department, Ministry of Munitions, 10, Great Stanhope Street, London, W.

A Manufacturers' Directory.—The National Union of Manufacturers (Inc.) has issued a very presentable directory of its members. The Union has now a large membership, and a supplementary list of those who have joined since the completion of the list in the directory shows that considerable progress is being made. A number of electrical and engineering firms appear. In addition to the circulation of the directory among members, some thousands of copies are being distributed through the British Dominions overseas to various trade associations and manufacturers, and particularly to producers of raw materials. Copies may be purchased (5s.) from the Secretary at 6, Holborn Viaduct, London, E.C.1. Full information is given relating to the personnel of the various Committees of the Union. This is followed by an alphabetical list of firms in the organisation, with a brief statement of their businesses, telegraphic addresses, telephone numbers, &c.; also a classified list of manufacturers and producers. The remainder of the book, nearly one-half of the whole, consists of members' advertisements.

Westinghouse Electric Export Deputation Arrives.—The *Financier* announced, on February 14th, that Brigadier-General G. Tripp, Mr. C. A. Terry, Mr. L. A. Osborne, Mr. M. Foster, Mr. G. C. Bennett, Mr. G. M. Dahl and members of the Westinghouse Electric Export Co. had arrived in London from America.

Ministry of Reconstruction.—On Monday last the Ministry of Reconstruction offices were transferred from Queen Anne's Gate Buildings, Westminster, to the Windsor Hotel, Victoria Street.

Engineering Ballot on 44-Hour Week.—According to the *Times*, the ballot of the Mersey Federation of Engineering and Shipbuilding Trades (representing 29 Unions) and the Amalgamated Society of Engineers on the length of the working week was declared last Friday as follows:—For a 44-hour week, 10,175; for a 40-hour week, 7,903; majority for a 44-hour week, 2,272. In favour of working while negotiations proceed there were 14,466 votes, and in favour of ceasing work to obtain a reduction of hours 3,156, showing a majority of 11,310 against a strike.

New German Ministry for Foreign Trade.—The *D.A.Z.* announces that negotiations are being conducted between the Foreign Office and the Economic Office with regard to the formation of a new department which is to deal with foreign trade. The idea is to create a bureau of information to which all Government bodies and private business people could apply in regard to all questions relating to the import and export trade. In the new department these sections of the Foreign Office and the Economic Office, which have hitherto been dealing with foreign trade, are to be united. A journal, *Nachrichten für Handel, Industrie, und Landwirtschaft* (commercial, industrial, and agricultural news) is to be issued. The late German Consul-General in New York, Herr Falcke, has been appointed to organise this new department on behalf of the Foreign Office in conjunction with a Commissary delegated from the Economic Office.—*Der Welthandel*, Dec. 20th.

Reconstruction Problems.—No. 13 of the Ministry of Reconstruction series of 2d. pamphlets deals with the subject of "Rural Industries."

Export Restrictions.—The *London Gazette* for Feb. 14th contains particulars of additions to, and relaxations of, export restrictions.

Manufacturers' Organisations Combine for Export Trade Effort.—The Provisional Committee of the British Manufacturers' Corporation has issued to firms associated with the Corporation a memorandum describing developments in connection with Sir Charles Mandleberg's scheme for British export trade expansion.

In the closing months of last year the Overseas Trade Committee of the Federation of British Industries desirous of a progressive overseas trade policy, reported that after careful consideration they had come to the conclusion that the principles first formulated in Sir Charles Mandleberg's scheme were sound, and that they had made them the basis of their own proposals. In these circumstances they thought it would be a waste of energy, and would lead to overlapping if the scheme went through independently, and they suggested a fusion of the B.M.C. with the Federation for the purpose of carrying out the schemes. A general meeting of the Federation on December 12th approved the proposals, and as the result of the negotiations then opened conditions of fusion have been agreed upon by the respective Committees, and these will be submitted to a general meeting of the British Manufacturers' Corporation on February 20th. We learn that the terms of the proposed amalgamation make it clear that the export trade development policy on which the Federation is about to embark is identical in essentials with the scheme first suggested by Sir Charles Mandleberg. Under the agreement the British Manufacturers' Corporation is to have immediate and substantial representation on the Committee that will administer the scheme.

Exports to China and Siam.—The *London Gazette* for February 14th and that for February 18th contain further lists of persons and bodies in China and Siam to whom exports may be consigned.

Agencies Wanted.—A Barcelona firm of electrical and mechanical engineers with branches at Madrid and Lisbon, already representing important British engineering firms, desires to take up the representation of British manufacturers and exporters of electric motors, electric lighting sets, Diesel engines, electric cables, turbo-alternators, &c. The managing director of the firm is at present in the United Kingdom. (Reference No. 219.) Particulars from the Department of Commercial Intelligence, 73, Basinghall Street, E.C.

Municipalities and Enemy Contracts.—Hammersmith B.C. Special Purposes Committee, at the last meeting of the Council, recommended that the Council refuse to accept any tenders from, and that no contracts be entered into with, any firms directly or indirectly connected with the Enemy Powers, and that no subcontracting be allowed with firms connected with the Enemy Powers.

Dutch Embargo on German Goods.—The Dutch navigation companies have, so *Deutscher Aussenhandel* (December 10th) claims to have heard from trustworthy sources, been warned by official representatives of England and France, through confidential circulars, against warehousing German goods, since the Allies wish to pass a resolution that for two years after the war no German goods may be shipped *via* neutral countries without their consent.

Hours of Labour in the Rubber Trade.—"Subject to certain conditions necessary to maintain output," the National Joint Industrial Council of the Rubber Manufacturing Industry recommends a 47-hours week.

Reunion of ex-British Westinghouse Men.—On Friday last, at the Connaught Rooms, London, 150 ex-British Westinghouse staff foregathered, under the chairmanship of Mr. C. Dalley, who presided in the regrettable absence of Prof. Miles Walker, for the first reunion dinner. Upwards of 100 old Westinghouse men wrote expressing regret at their inability to attend. After the Royal toasts had been honoured, a silent toast to the memory of the Westinghouse men who had fallen in the war was drunk. Mr. L. R. Morshead (the chairman of the Reunion Committee) then stated that the response which had been received to the suggestion for the reunion was so good that it was hoped to make it an annual feature. The proposal was to form an Association of old Westinghouse men. Between the speeches, Mr. H. Coupe officiated at the piano and other gentlemen contributed humorous items. At the termination of the proceedings each guest was presented with a souvenir programme, which included many humorous features. Mr. Richardson, whose address is 14, Sydney Road, Richmond, Surrey, would like to hear from all ex-Westinghouse men who will join the Association and turn up at the next annual gathering.

Lamp Prices in Germany.—As from January 28th, increases in the prices of incandescent lamps have been made in Germany by the A.E.G., the Bergmann Co., the Osram Works, the Radium Electricity Co., Siemens & Halske, and the Siemens-Schuckert Works. The augmentations have been made in the sense that war-time additions have been abandoned and new basis prices have been substituted. Under the new arrangement the prices of wire lamps with pear-shaped bulbs ranges from 3 marks to 3·75 marks; wire lamps in globe form are at 3·60 marks to 7 marks; and gas-filled lamps are at 5 marks to 110 marks, exclusive of the lamp-tax in each case. As the makers expect an improvement in the present difficult conditions, it is said that the above prices have been calculated so as not to include the whole of the additional cost of production arising from the existing labour and other circumstances.

Trade Announcements.—MR. HARRY FOWLER, electrical engineer, has resumed business at 25, William Street, Windsor.

MESSRS. HICK DIESEL OIL ENGINES, LTD., have removed to larger offices at 70, Queen Street, London, E.C. 4.

Mr. E. H. Miller, sales manager in the meter department of the British Westinghouse Electric and Manufacturing Co., Ltd., has left the company, and has started the CROMWELL ENGINEERING WORKS, for the manufacture of small electrical details, at Romsey Road, Old Shirley, Southampton. Catalogues of wires, screws, loose brass, &c., are required.

MR. THOMAS S. WALLACE, electrical contractor, having been released from the Royal Marine Light Infantry S.H.C.D., has resumed business at Breadalbane Place, Oban, Argyll, and invites manufacturers to send catalogues and trade terms.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., are removing their London Vehicle Battery Depôt from 70, Romney Street, Westminster, to more commodious premises at 18, Hereford Road, Bayswater, London, W. 2, where all overhaul and repair work will in future be carried out.

Bankruptcy Proceedings.—R. E. CONNOLD, late of 6A, The Parade, Canterbury.—Supplementary dividend of 3½d. in the £, payable February 22nd, at the O.R.'s office, 68A, Castle Street, Canterbury.

Liquidations.—PORTABLE ELECTRIC MOTORS, LTD.—Meeting of creditors, February 22nd, at 12, Lime Street, London, E.C.; Mr. A. F. Newton, liquidator.

DEVONPORT AND DISTRICT TRAMWAYS CO.—A meeting will be held on Friday, March 21st, at 136, Aldersgate Street, E.C., to hear an account of the winding up from the liquidator, Mr. P. N. Gray.

South African Tour of British Industrial Centres.—The Federation of British Industries has organised, with the support of the various Dominion representatives in London, a series of tours of members of the various Dominion Imperial Forces to the industrial centres of Great Britain. The first of these tours started this week, when a representative party from the South African Imperial Force was entertained by the Federation at the Princes Restaurant before leaving for Grantham. During their tour the South African representatives will have the opportunity of visiting the firms of Ruston & Hornsby, Ltd.; the Birmingham Railway, Carriage, and Wagon Co., Ltd.; the General Electric Co., Ltd., at Witton; the Wolseley Motor Co., Ltd.; and the Handley Page Aeroplane Works.

Book Notices.—*Manual of Electrical Undertakings and Directory of Officials.* 1918-19 Edition. London: Electrical Press, Ltd. 22s. 6d. net.—The form and nature of the contents of this directory are so well known by now that little need be said about it, beyond the fact that it contains in a very accessible form great stores of statistical and general information, including names and addresses of officials, relating to nearly 3,000 electrical undertaking in the British Empire, representing a capital of 490 millions sterling. It has a 100-page section reviewing the progress of the year, after which 10 times that number of pages are set apart for material concerning light, power, and traction undertakings, and smaller sections for telegraph and telephone, manufacturing and miscellaneous, Colonial and British Possessions. A directory of 20,000 directors and officials and a number of maps are also features of the volume, which would have made its appearance at an earlier date but for production difficulties, which have confronted the printing and publishing trades as they have everybody else.

What Others Say. In view of the controversy which has taken place as to whether starters should be standard on after-the-war cars, a little booklet which we have received from C. A. Vandervell & Co., Ltd., is of interest. It sets forth the opinions of the foremost journals, technical and otherwise, on the electric starter as presented in its newest form by "C.A.V.," and goes a long way to show how the Press in general views the adoption of the electric starter for motor cars.

"A Criticism of the First Interim Report of the Committee on Currency and Foreign Exchanges." By Mr. Arthur Kitson, president of the British Banking Reform League. The League: Chamber of Commerce Buildings, Birmingham. 1s.

"Memorandum on the Industrial Situation After the War: The Garton Foundation." London: Harrison & Sons. Price 2s. net.

"Public Utility Rate Fixing." By C. E. Grunsky. Pp. 169; illus. San Francisco: Technical Publishing Co.

"The Practical Telephone Handbook." By J. Poole. Pp. xxiii + 725; 585 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 12s. 6d. net.

Auction Sale.—By direction of the Ministry of Munitions, Messrs. Edwards, Son & Bigwood will sell by auction, at Birmingham, on the premises, on Monday, February 24th, and following days, valuable engineering and munition-making plant and machinery, the property of the Ministry of Munitions, now lying at, and recently in use at, the Longbridge Works of the Austin Motor Co., Ltd.

Plant for Sale.—Bootle Corporation Electricity Department invites offers for the purchase of surplus plant at Pine Grove electricity work, consisting of Lancashire boilers, superheaters, economisers, Ferranti and Bellis engines and dynamos, &c. Full particulars are given in our advertisement pages to-day.

Bradford Corporation Electricity Committee invites offers by February 28th for one cross-compound Corliss vertical enclosed engine, coupled to a 1,000-KW. Westinghouse generator, with oil separator, air pumps, &c.

Non-Ferrous Metal Industry Act.—The *London Gazette* for February 18th contains further additions to the list of licences granted under the Act.

LIGHTING AND POWER NOTES.

Aylesbury.—EXTENSIONS.—The T.C. has provisionally agreed to supply 200 H.P. of electricity forthwith, 500 H.P. by April next, and 1,000 H.P. next year, to Messrs. W. Cubitt & Co., Bicester Road. It is proposed to apply for a loan for the provision of a 1,000-KW. generating set, and a further 1,000-KW. set is proposed, in view of further extensions.

PRICE INCREASE.—The T.C. has decided to increase the charges for street lighting by 20 per cent.

Barnsley.—SALARIES.—The T.C. has acceded to the demand of the E.P.E.A. that the wages of power engineers be advanced by 20 per cent. on the salary paid on July 31st, 1914, plus £90 per annum, as from March 31st last. This is also to apply to the commercial assistant.

Batley.—YEAR'S WORKING.—For the year ending March 31st, 1918, the working of the Corporation electricity undertaking resulted in a loss of £982, compared with a profit of £45 in the previous year. The cost of coal increased by £600, and the sales declined by 100,000 units.

Belfast.—STRIKE.—After a conference with the Irish Executive, the Commander-in-Chief of the Forces in Ireland gave permission for troops to be used in connection with the strike in Belfast, and on Saturday troops took control of the electricity works and gas works, in conjunction with the permanent officials. Upon this protection being afforded, the employés returned in large numbers, and a normal supply was available for lighting and power later in the day. The street switch-boxes were guarded, and a notice issued to the effect that the penalty for injuring or interfering with the electricity supply was five years' penal servitude, and a reward of £100 was offered for information leading to the conviction of anyone committing such an act. It is estimated that the resumption of the power supply enabled 45,000 persons to resume work in one industry alone. A picket was sent on Monday to bring out again several members of the A.S.E. who had returned to work at the electricity station, but without success. A limited tramway service was run on Sunday, and was improved on Monday. Two members of the E.T.U., employed by the Corporation Electricity Department, charged under the new Defence of the Realm Regulation with breaking their contract of service, were remanded on bail on Monday. The defendants were shop stewards, and were at work up till Saturday, but did not resume at midnight on Sunday. Late on Monday night the Strike Committee decided to leave the question of the acceptance or rejection of the employers' offer to the individual Unions; this practically meant the final collapse of the strike.

A full tramway service was being run on Tuesday, and the men had returned to work in practically all industries by Wednesday on the 47-hour week basis, pending a National settlement.

Bury.—Proposed Extensions.—The T.C. has decided to apply for L.G.B. sanction to a loan of £94,000 for electricity purposes, to be expended as follows:—Buildings, £19,000; boilers, £16,500; seatings, flues, &c., £2,000; economisers, pipes, &c., £3,500; ash-removal plant, £4,000; switchboards, £1,500; one 5,000 to 8,000-kw. turbo-alternator, £41,000; condensing pipes, &c., £6,000; and railway sidings, £500. The scheme has been approved by the B. of T.

Birmingham. — Wages. — The E.S. Committee has extended the award of 5s. per week, which had been already granted to the engineers, to all men in its employ engaged in the generation and distribution of electricity.

Burton-on-Trent.—Street Lighting.—The T.C. has decided to install electric lighting in the High Street and Station Street, by means of 600-c.p. lamps suspended from the tramway standards.

Bristol.—Extension of Supply.—Arrangements have been completed for the supply of electricity by the T.C. to Messrs. Derham Bros., Ltd., at Southwell, which is outside the Council's area.

Bury St. Edmunds.—New Mains.—The electrical engineer has recommended the T.C. to lay a new main to the Northgate area, at an approximate cost of £2,500.

Continental.—Belgium.—Several new electricity supply undertakings have lately been formed in Belgium, including the Société de la Central Electrique de Rettigny-Renglez, at the town of that name, the Société d'Electricitè de et à Lantin, and the Société d'Electricitè M.C., organised at Ghent. The first two are co-operative undertakings.

France.—La Société Hydro-Electrique de l'Isère has been formed at Lyons, with a capital of £320,000, to utilise the water power of the River Isère, near St. Nazaire-en-Royans. The Société Metallurgique du Fravol and the Société de l'Electricitè de la Vallèe du Rhone are interested in the new undertaking.

Germany.—Notwithstanding the settlement of the strike at the electricity generating stations, Berlin remains unlighted on account of the lack of coal.—*The Times.*

Spain.—A Comision Permanente Espanola de Electricidad has been appointed by the Government to draw up a scheme for the establishment of a State electricity supply undertaking, which will cover the greater part of the country. The estimate for the scheme is £5,200,000.

Sweden. — Among the new concerns, mainly of a small character, recently formed to establish electricity supply undertakings, are the Alfsakers Kraft Aktiebolag, of Anneberg; the Aneboda Kraft Aktiebolag, of Lamhult; and the Omne Elektriska Kraft Aktiebolag, of Nordingra.

Dartford.—Price Increase.—The U.D.C. has advanced the price of electricity for power purposes by a further 15 per cent. as from February 10th.

The Council has refused to consent to the West Kent Electric Co. supplying electricity to the Joyce Green Works of Messrs. Vickers, and has informed the firm that it is prepared to negotiate for a supply from the municipal works.

Dover.—Price Increase.—The T.C. has decided to advance the weekly payment for electricity supplied to the Pier Cottages from 6d. to 9d., and to 1s. where there are lodgers.

Salaries.—Regarding the demand of the E.P.E.A. that the salaries of the technical staff at the electricity works should be increased by 20 per cent., plus £90 a year, the T.C. has decided to reply that substantial advances had already been recommended.

Dundee.—Extensions.—The Electricity Committee has approved of plans for the proposed extension of the electricity works at Carolina Port.

Ealing.—Price Increase.—The T.C. is seeking permission to increase the price of electricity from 8d. to 10d. per unit. Alderman Peal (chairman of the Electricity Committee) explains that the coal bill this year will be £14,000, as against £8,000 in pre-war days, and that the estimate shows that there will be a loss of £5,300 if the current price continues.

Edinburgh.—Year's Output.—The annual report of the Corporation electricity department shows that the number of units sold for all purposes during the past year amounted to 20,945,404, as compared with 17,997,251 in the previous year.

The Corporation has decided to ask the Controller of Mines to extend to Scotland the recently announced increase of 25 per cent. of gas and electricity rations.

Epsom.—Chief Engineer's Salary.—The U.D.C. has referred to arbitration the claim of the Electrical Power Engineers' Association that the salary of the electrical engineer, Mr. Young, should be fixed at about £646 per annum.

Grantham.—Proposed Municipal Supply.—The T.C. has appointed a Committee to go into the question of taking over the E.L. undertaking.

Hastings.—Price Increase.—The T.C. has increased the charge for electricity for public lighting from 2d. to 3d. per unit.

Hebden Bridge.—The electrical engineer has been authorised to purchase 200 yards of 0·1-in. twin-armoured, paper-insulated cable and new switchgear, to cope with the increasing power load in the Hangingroyd district.

Hull.—Proposed New Plant.—The acting electrical engineer has recommended the Electricity Committee to replace Nos. 8 and 9 engines by a synchronous motor. This would bring the plant up to date, and effect a saving of 3,000 tons of coal per annum. It was decided to negotiate for the plant, and report further on the matter.

Keighley.—Wages.—A dispute between the Electricity Committee and its employés has been settled by the war wages being increased by 6s. per week, making the total 28s. 6d., payable from the first pay-day in December; the claim as to the working hours has been deferred pending further inquiries.

Kirkcudbrightshire.—E.L. Schemes.—The burghs of Gatehouse, Creetown, and Newton Stewart are considering E.L. schemes; the last-named is estimated to cost over £50,000.

Lincoln.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the T.C. of £75,000, for the purchase of Messrs. Clayton & Shuttleworth's power station.

Liverpool.—Year's Working.—The total income of the Corporation electricity department for the year ended December 31st last amounted to £504,158 and working expenses to £301,479. Of the balance (£202,679) interest absorbed £73,082, sinking fund contributions, £58,078, renewals fund, £21,519, and £50,000 was contributed to the relief of the rates. The reserve fund now amounts to £18,445, the renewals fund to £126,472, and the fuel guarantee fund to £9,242. The capital expenditure on the undertaking totals £2,254,659, of which £25,679 was incurred during the past year.

London. — Hammersmith. — Year's Working. — The working of the B.C. Electricity Department for the year ended March 31st, 1918, resulted in a net profit of £1,464, compared with £2,476 in the preceding year. The income was £101,232, against £79,500, and working expenses amounted to £78,217, against £55,136. Interest on loans amounted to £7,742, against £8,140, and debt redemption to £13,340, against £14,645. The capital outlay at the end of the year totalled £399,470, an increase of £5,565. The maximum load recorded was 7,248 kw., against 7,050 kw; the capacity of the undertaking was 10,300 kw. Units generated during the year numbered 20,753,920, against 17,226,200, and 1,116, against 1,555, were purchased; 17,892,928, against 14,550,147 were sold to private consumers, and 242,815, against 256,523, for public lighting; 2,498,794, against 2,207,789, were used on the works, and 120,499 were unaccounted for, against 213,296. The reserve fund now totals £33,370. The price of coal increased by 62½ per cent. over the last pre-war year. The average price received was 1·29d. per unit.

Proposed Linking-up.—The E.L. Committee has recommended the B.C. to inform the Conference of Electricity Undertakings in Greater London that it is in favour of the formation of a Joint Board for the purpose of interconnecting existing stations, and the provision of a site for a bulk supply station either for the S.W. London area or such other area as may be determined upon.

Shoreditch.—Salaries.—The Lighting Committee has agreed to the application of the E.P.E.A. for an increase of salaries for its members of 20 per cent. advance on pre-war rates, plus £90 per annum. A further bonus of 5s. per week, making a total of 28s. 6d. per week, has been granted to other employés as from December 5th last.

Kensington.—Price Increase.—The Kensington and Knightsbridge E.L. Co. has decided to increase the price of electricity by two further additions of 10 per cent., one to take effect from the end of the March quarter and the other from the end of the June quarter.

Londonderry.—Price Increase.—The electrical engineer has recommended the Corporation to increase the charges for electricity from 15 per cent. to 33⅓ per cent. on existing charges.

Masham (Yorks.).—Proposed Municipal Supply.—The U.D.C. has asked the sanction of the ratepayers to acquire the electricity undertaking.

Matlock.—Proposed E.L.—The U.D.C. is considering a scheme for the production of electricity by the utilisation of the water power of the Bentley Brook.

Southport.—Proposed Extensions.—In connection with its application for a loan of £132,000 for electricity extensions, the T.C. has decided to furnish the L.G.B. with an estimate of the cost per unit of generating electricity with the new plant during the years 1921-1924, and also the cost per unit for renewal and sinking funds. The L.G.B. has also been informed that the Council is willing to take a bulk supply from a central station, if it can be proved that the latter method is the more economical. The B. of T. has informed a deputation that Southport is one of the areas definitely excluded from the National scheme, and the Board has approved the proposed extensions.

South Wales.—Strike.—The fitters, wiremen, &c., on strike in South Wales are considering a proposal to form a company for the undertaking of electrical contracting work.

Mr. H. Wintle, secretary of the South-Wales Branch of the Electrical Contractors' Association, informed a Press representative that the Association had advocated this for some years, and he sincerely hoped that the men would give the proposal every consideration, because the employers felt that if the men would only run a business on their own account, especially on a co-operative system, they would know the various aspects from the employers' point of view, with which they were not conversant at present.

Swansea.—Wages.—The Electricity Committee has increased the wages of certain of its employés who are members of the A.S.E. to £305 10s. per annum, and the men have also been placed on the staff; it was mentioned that before the war their wages were £130 per annum.

Tonbridge.—Price Increase.—The U.D.C. has advanced the price of electricity for outside lighting to 3d. per unit, from April 1st; for bioscope supplies to a flat rate of 4d., as from February 1st; and for power from 33⅓ per cent. increase to 50 per cent., from April 1st.

Taunton.—Proposed Loan.—The T.C. has applied to the L.G.B. for sanction to a loan for the installation of a 500-kw. turbo set, and other plant.

Price Increase.—The T.C. has decided to increase its prices for electricity to 75 per cent. above pre-war charges.

Tuam (Co. Galway).—Proposed E.L.—The services of Mr. J. P. Tierney, of Dublin, have been engaged by the municipality, in connection with an E.L. scheme.

Walsall.—Proposed Extensions.—The E.S. Committee proposes to extend the supply of electricity to the Leamore district, and to purchase transformers and switchgear, at an estimated cost of £4,200.

Wexford.—Proposed E.L.—A Corporation Committee appointed to consider the question of public lighting by electricity has reported in favour of the scheme.

Wolverhampton.—Wages.—The T.C. has agreed to an award of the Court of Arbitration, dated February 5th, granting an increase of 5s. per week to employés of the electricity department over 21 years of age, and 2s. 6d. per week to those under 18.

Yorkshire.—Rural Electricity Supply.—The Reconstruction Committee of the East Riding County Council has reported to the Council on the desirability of extending the supply of electricity within its area.

TRAMWAY AND RAILWAY NOTES.

Blackpool.—Proposed Purchase.—The Fleetwood U.D.C. has decided to oppose the application of the Blackpool T.C. for powers to purchase the undertaking of the Blackpool and Fleetwood Tramroad Co.

Bradford.—Tramcar Letter-Boxes.—The T.C. has decided to make representations to the postal authorities, with a view to placing letter-boxes on tramcars, which was the practice some years ago.

Italy.—Steps have been taken by the communes interested to bring about the construction of an electric tramway between Poggio Mirtelo and Terni.

A Commission has been nominated to submit plans for the electrification of the tramway between Alessandria and Casala.

The Società Brioschi per Imprese Elettriche, of Milan, is increasing its capital from 6 million to 12 million lire, for the purpose of carrying out, in conjunction with the province of Piacenza, the electrification of 200 miles of railway.

Lincolnshire.—Proposed Light Railways.—The Holland County Council has adopted a report of a scheme for the construction of 85 miles of light railways in the county, at an estimated cost of £640,000.

London.—District Railway Mishap.—A derailment, caused by a broken axle, took place on Saturday last at Bromley-by-Bow. Both the up and down tracks were completely blocked, and the service between Bromley, East Ham, and Barking was entirely suspended.

It is announced that from March 1st more trains are to be run at night on the North London Railway between Broad Street and Richmond, Poplar, and Bow.

Ticket Concessions.—Tube passengers who had taken out packets of workmen's tickets before the strike can legally demand the return of their money, says the Suburban Railway Passengers' Association, and should apply to the general manager of the company concerned. On renewing their tickets season-ticket holders on the District Railway have found that six days' extra travelling is allowed on the new ones to compensate for the strike.

Proposed L.C.C. Extensions.—The Highways Committee has recommended the L.C.C. to obtain power for the construction of the following tramway extensions and linking-up schemes:—Charles Street to Blackfriars Bridge; Gray's Inn Road to Farringdon Street; Aldgate Terminus to Aldgate Station; Hampstead Road to Oxford Street; Seven Sisters Road to Stamford Hill; Southampton Row to New Oxford Street. Exclusive of street widenings, the estimated cost is £429,140. The Council will also consider the running of omnibus services to link-up tramway dead ends.

Rail Welding.—The L.C.C. Highways Committee has recommended the provision of electric welding equipment for tramway track welding, at a cost of £700.

Eight-hour Day.—The L.C.C. tramcar washers are to have an eight-hour day, on the understanding that they undertake the same amount of work in eight hours as has hitherto been done in nine.

Hours of Labour.—The Transport Workers' Federation has asked the L.C.C. to grant a working week of 44 hours to its tramway employés.

West Hartlepool.—At a special meeting of the T.C., on the 14th inst., a proposal was approved to promote a Parliamentary Bill to empower the Corporation to construct and work tramways from the present light railway at Seaton Carew to Greatham Creek, and from the end of the present tramway in Stockton Road to a junction with the Seaton Carew line; also to run motor-'buses in and beyond the borough to Greatham Creek, and in other parts outside the borough, as may be deemed expedient. Power is also sought to increase the tramway fares and to charge specially-increased fares on Sundays and public holidays.

TELEGRAPH AND TELEPHONE NOTES.

Figures in Cablegrams.—The Eastern and Associated Telegraph Companies notify that it has been decided, by arrangement with the General Post Office, to accept figures in the text of deferred telegrams as a temporary measure. Figures, when not expressed in words, will be counted and charged for at the rate of one word for each group of five characters. The following places are exceptions to the above:—French Colonies, China, Brazil, Argentina, Punta-Arenas, Bolivia, and wireless offices in Peru.

Postal Workers' Claims.—At a meeting of the London Branch of the Postal and Telegraph Clerks' Association, on Saturday last, a resolution was carried calling for the immediate convening of a Postal Congress of the rank and file of the Associations to formulate a charter of hours, wages, conditions, and status, covering the claims of the men and women in the Postal Services, the Army men now serving with the Postal Service, the permanent staff, and the temporary staff, the charter to be submitted without delay to the Postmaster-General, and negotiations to be opened with the railway Unions with a view to synchronising and co-ordinating any action considered necessary to enforce it. The chairman of the Branch, Mr. H. L. Upcott, said that the strike weapon might become an imperative necessity if their demands were not granted. They hoped to join the triple alliance of railwaymen, miners, and transport workers.—*The Times.*

Telegraph Messengers.—It has been decided to revert to the pre-war conditions of employing boy telegraph messengers in the Post Offices. The change will apply equally to London and the provinces. The change is being made neither for reasons of efficiency nor of finance. It is felt that the night work required is not quite suited to girls of 14, and that, when they reach the age of 18, they cannot be absorbed inro the permanent *personnel* of the Post Office. For some years all the boys employed as messengers have been absorbed into the permanent establishment of the Post Office, chiefly as postmen.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Sydney.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

May 19th. Municipal Council. Boiler-house equipment. Specifications, on February 17th, from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. See "Official Notices," Jan. 31st.

P.M.G.'s Department, Queensland. March 26th. Telegraph and telephone material, schedules 447/451 and 453. Specification from Australian Commonwealth Offices, Room 405, Australia House, Strand, W.C. See "Official Notices" to-day.

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

Aylesbury.—Corporation Electricity Department. One 1,000-kw. generating set complete; two 500-kw. rotary converters. See "Official Notices" February 14th.

Belfast.—February 24th. Electricity Department. Electric and hand cranes, pumps and tanks. See "Official Notices" January 17th.

Belgium.—The municipal authorities of Ixelles (170, Chaussée d'Ixelles, Ixelles, Brussels) are inviting tenders for the supply of electricity meters and armoured low-tension cables.

Birmingham.—March 5th. Tramways Committee. Additional rolling stock. See "Official Notices" February 7th.

Dublin.—March 3rd. Electricity Supply Committee. Extra-high-pressure and low-pressure cables. See "Official Notices" to-day.

King's Lynn.—March 3rd. Corporation. One 1,000-KW. turbo-alternator, one 400-KW. rotary converter or motor-generator, and one 400-KW. transformer and switchgear. See Official Notices" February 7th.

Lincoln.—March 5th. Corporation. Four water-tube boilers with stokers, &c., complete; two 3,000-KW. turbo-alternators with condensers, &c.; extension of E.H.T. switchboard, &c.; two 750-KW. rotary converters, &c.; two 2,000-K.V.A. three-phase transformers, &c. Specifications from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. See "Official Notices" Feb. 7th.

Manchester. — March 11th. Tramways Committee. Supply, &c., of (*a*) permanent-way special track work; (*b*) permanent way points, tongues, and hardened steel centres. Mr. J. M. McElroy, general manager.

March 11th. Tramways Committee. Stores, including several electrical items. See "Official Notices" to-day.

Mansfield.—Corporation Electricity Committee. 1,250-1,500-KW. turbo-alternator, condensing plant, 500-KW. rotary converter, transformer, and switchgear. See "Official Notices" February 14th.

Portsmouth.—March 4th. Tramways Committee. Tramway stores for six months. See "Official Notices" February 14th.

Rhondda.—March 5th. U.D.C. Electricity Department. Twelve months' supply A.C. meters, cable, joint boxes, compound cut-outs, &c. See "Official Notices" February 14th.

Salford.—February 24th. Electric light installation at Regent Road Police Station. Borough Engineer, Town Hall.

Swindon. — March 15th. Electricity and Tramways Department. Two double-deck tramcars. See "Official Notices" to-day.

Taunton.—Electricity Department. One 500-KW. steam turbine generator, travelling crane, cables and meters. See "Official Notices" February 14th.

CLOSED.

Australia.—Victorian Railways Department. Accepted.
250-volt rubber-covered cable 7/18, £66 per mile; 7/30, £50 per mile. Made in Japan. Australian General Electric Co.

P.M.G.'s Department, Queensland:
500 C.B. automatic telephones, wall pattern, £1,856; 500 do. table pattern, £186.—Automatic Telephones (Australia), Ltd.

P.M.G.'s Department, Victoria:
200 C.B. automatic telephones, wall pattern, £741; 200 do. desk do., £741.—Automatic Telephones (Australia), Ltd.

P.M.G.'s Department, N.S.W.:
Material for maintenance of automatic telephone equipment, £496.—Automatic Telephones, Ltd.
180 micro-telephones, £378.—Western Electric Co.

N.S.W. Public Works Department:
Electric lift at Goulburn Hospital, £1,079. Standard Waygood Hercules, Ltd.

COBURG (Victoria) T.C.:
Transformers, £691.—G. Weymouth.
H.T. equipment and meters, £909.—Australian General Electric-Co.
Copper cables and fuses, £4,232.—B. I. and Helsby Cables, Ltd.
Street lamps, £430.—Lawrence & Hanson.
Insulators, £373.—Australian Porcelain Co.
Poles and erection, £1,744.—W. Clements. *Tenders.*

Barnsley.—Corporation Electricity Committee:—
Copper bands and steel flanges, £85 per ton.—Jones Wildsmith.
Steam pipes and isolating valve, £85.—Babcock & Wilcox.

Glasgow.—Tramways Committee:—
Bowser pump and storage tank.—S. F. Bowser & Co.
Multijector air pump for Pinkston station.—Mirrlees, Watson Co., Ltd.
3/4-ton lorry chassis.—The Albion Motor Car Co., Ltd.

Electricity Committee:—
Turbo-alternator, condensing plant and transformer, £133,736.—Dick, Kerr and Co., Ltd.

London. — HAMMERSMITH. — Electricity Committee. Recommended:—
175 fuse boxes, 200 service boxes, 24 H.T. straight joints, 18 H.T. tee joints, 12 draw-box frames.—
W. Lucy & Co. (recommended) £444.
W. T. Henley's Telegraph Works Co., £656.

500 yds. each 1 sq. in. ·05 sq. in. service cable.—

Macintosh Cable Co., Ltd. (recommended)	£346
Western Electric Co., Ltd.	389
Callender's Cable and Construction Co., Ltd.	392
B.I. and Helsby Cables, Ltd.	395
Henley's Telegraph Works Co., Ltd.	398
W. T. Glover & Co., Ltd.	402

100 new lanterns for street lamps—

W. Edgar (recommended)	£194
W. Lucy & Co.	195

Conversion fittings, &c.—94s. 9d. each., **W. Lucy & Co.** (recommended).
10,000 tons of Wernddu Thro' coal, f.o.r. Shepherd's Bush, at 38s. 9d. per ton.—**Messrs. Judd, Budd & Sons** (recommended).

Powdered fuel plant.—The Electricity Committee recommends that the tender of the Powdered Fuel Co. be accepted for—
Powdered fuel plant, £14,100; electric motors for driving ditto, £1,770; additional pulveriser and accessories and additional distributing mains, £6,600; motors for driving same, £1,015. Total £23,485.

The company have offered to enter into guarantees that there will be a saving of £7,000 per annum on fuel and labour, provided all the boilers are fired by means of the new plant, or proportionately for a less number of boilers. The Committee also recommends that the tender of the Powdered Fuel Co., for £39,925, for additional plant be provisionally accepted, subject to the plant being required after the installation of the first part. The engineers estimate of the cost of the building for housing pulverising plant, &c., is £6,700.

BATTERSEA.—Electricity Committee. Recommended:—
Air cooler and heat conservator plant for 5,000-KW. extension plant, £960.—Babcock & Wilcox, Ltd.
In connection with annual contracts the Committee recommends that it be authorised to take such action as it may consider advisable to obtain tenders or to arrange for the works and services to be carried out in the ensuing year.

Sunderland.—T.C.—
Superheater blanks.—James Thompson & Co.
E.H.T. cable.—British Insulated and Helsby Cables, Ltd.
Creosoted redwood capping.—Armstrong, Addison & Co.
E.H.T. c.i. joint troughs.—J. H. Waterston & Co.

Winchester.—T.C.:—
200-gallon water-softening plant, £110.—Wm. Boby & Son.
24-in. diameter electrically-driven fan and set of automatic shutters, £33.—James Keith & Blackman Co., Ltd.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, February 21st. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Annual general meeting. Adjourned discussion on "Electric and Oxy-Acetylene Welding."

Junior Institution of Engineers.—Friday, February 21st. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Earthquakes and how they are Recorded," by Mr. J. J. Shaw.

(Midland Section).—Friday, February 28th. At 8 p.m. At the University, Birmingham. Paper on "The Boys' Welfare Movement," by Mr. T. Lewis.

Manchester Association of Engineers.—Saturday, February 22nd. At 6.30 p.m. At the Grand Hotel. Paper on "Hardness Determination of Metals," by Prof. C. A. Edwards.

Birmingham and District Electric Club.—Saturday, February 22nd. At 6.30 p.m. At the Grand Hotel. Annual dinner and concert.

Greenock Association of Electrical Engineers.—Saturday, February 22nd. Visit to Brown & Polson's Corn Flour Works, Paisley.

Chief Technical Assistants' Association.—Saturday, February 22nd. At 3 p.m. At Anderton's Hotel, Fleet Street, E.C. Discussion on "Problems in Connection with Linking-up," to be opened by Mr. Bowden.

Royal Society of Arts.—Monday, February 24th. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor lecture "Scientific Problems of Electric Wave Telegraphy," by Prof. J. A. Fleming, F.R.S.

Wednesday, February 26th. At 4.30 p.m. At John Street, Adelphi W.C. Lecture on "The Wage Problem in Industry," by Mr. W. L. Hichens, Chairman of Messrs. Cammell, Laird & Co.

British Industries Fair, 1919.—February 24th to March 7th. From 10 a.m. to 6 p.m. At the London Dock, Pennington Street Warehouse, E., near Mark Lane Station (District Railway).

Institution of Civil Engineers.—Tuesday, February 25th. At 5.30 p.m. At Gt. George Street, S.W. Papers on "The Flow of Water in Pipes and Pressure Tunnels," by Mr. F. J. Mallett, and "Discharge of Large Cast-iron Pipe Lines in Relation to their Age," by Mr. A. A. Barnes.

Industrial and Reconstruction Council.—Tuesday, February 25th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "Welfare Work," opening address by Miss Newcomb, Secretary of Central Association of Welfare Workers.

Illuminating Engineering Society.—Tuesday, February 25th. At 8 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Paper on "Some Notes on Railway Lighting and its Maintenance," by Mr. A. Cunnington.

Institution of Electrical Engineers.—Thursday, February 27th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "The Determination of the Efficiency of the Turbo-Alternator," by Dr. S. F. Barclay and Dr. S. P. Smith. On account of the author's illness, the paper on "The Co-ordination of Research in Works and Laboratories" will be read at a later date.

(North-Eastern Centre).—Monday, February 24th. At the Mining Institute, Newcastle. At 6.45 p.m. Discussion on "The Electrical Equipment of a Suburban Residence."

(North-Western Centre.)—Tuesday, February 25th. At 7 p.m. At the Engineers' Club, Manchester. Paper on "The Determination of the Efficiency of the Turbo-Alternator," by Dr. S. F. Barclay and Dr. S. P. Smith.

(Scottish Centre).—Tuesday, February 25th. At 7.30 p.m. At 207, Bath Street, Glasgow. Lecture on "The Navigational (Magnetic) Compass as an Instrument of Precision," by Mr. M. B. Field.

Royal Institution of Great Britain.—Friday, February 28th. At Albemarle Street, W. At 5.30 p.m. Lecture on "Ether and Matter," by Sir Oliver Lodge, F.R.S.

NOTES.

Copper Prices.—Messrs. F. Smith & Co. reports February 19th:—Electrolytic bars, £90; electrolytic sheets, no change; electrolytic wire rods, £100; H.C. wire, 1s. 0½d; silicium bronze wire, 1s. 4d.

Messrs. James & Shakespeare report February 20th:—Copper: Bar, sheets, and rods, £122.

Volunteer Notes.—ROYAL ENGINEERS VOLUNTEERS, LONDON ARMY TROOPS COMPANIES.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 8, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Wednesday, February 26th.—Drill and Military Engineering, 1830.
Friday, February 28th.—Range, 1830.

C. HIGGINS, Captain, R.E., *Adjutant.*

The Industrial Reconstruction Council.—A Special Conference will be held under the auspices of this Council, on Thursday, February 27th, at 5.15 p.m., in the Hall of the Institute of Journalists, 2 and 4, Tudor Street, E.C. 4, when an address will be given by Major Pells, R.E. (Assistant Director, Efficiency and Costs Section, Ministry of Munitions), on "Scientific Management in Industry." The lecture will be followed by a discussion. No tickets are necessary.

Institution and Lecture Notes.—Diesel Engine Users' Association.—Mr. Napier Prentice, A.I.E.E., engineer and manager to the Suffolk Electricity Supply Co., Ltd., has been re-elected president of the Association for the current year, and Mr. Percy Still, M.I.E.E., chief engineer and manager to the Chelsea Electricity Supply Co., Ltd., has been re-elected hon. secretary. The Association was founded in 1913, and in his annual report the hon. secretary referred to the rapid growth of its membership, which now includes about 200 subscribers. The Heavy Oil Engine Fuel Committee, consisting mainly of members of the Diesel Engine Users' Association, was formed in January, 1918, to assist the Mineral Oil Production Department of the Ministry of Munitions in the control and distribution of supplies of fuel oil, and in arranging, as far as possible, to substitute tar-oil fuel in place of imported petroleum fuel oil. The last two meetings of the year were taken up with the consideration of the subject of semi-Diesel oil engines, and, as a result, a very considerable amount of valuable information was collected and published in the reports of the proceedings of the Association.

Bradford Engineering Society.—At a meeting last week, Prof. G. F. Charnock, of the Technical College, lectured and demonstrated on "Oxy-Acetylene and Electric Welding." After explaining the advantages of these systems, Prof. Charnock said that the British Admiralty evidently had much confidence in electric welding for ship construction. A considerable extension of the process in ship work was taking place.

Royal Society of Arts.—Dr. J. A. Fleming, continuing his Cantor Lectures at the Royal Society of Arts on Monday, discussed the passage of electric waves through the atmosphere. The course of the current was greatly affected by the earth's atmosphere, consisting, above 50 kilometres, of gases that had not been mixed by winds, but had sorted themselves according to density, and still higher almost entirely of hydrogen and helium. There were, moreover, particles arriving at enormous velocity, pushed as they were by light from the sun, and, to illustrate the energy possessed by this fine solar dust, Dr. Fleming remarked that as much as would go in one's pocket had enough energy to run a battle cruiser for 24 hours. When these particles struck the earth's atmosphere it became heavily ionised, and the effect was that the current was turned downward, like the light that gave an inverted mirage. This, and not diffraction, was the cause of the bending of the ray round the earth.

Physical Society of London.—At the meeting on January 25th, a paper, entitled "Electrical Theorems in Connection with Parallel Cylindrical Conductors," was read by Dr. A. Russell. The formulæ, he said, for the capacity between the conductors and for the effective inductance were well known, but the values of the capacity and potential coefficients and of the inductance coefficients had not been determined. It was shown that for the case of a cylinder inside a cylindrical tube their values could in all cases be easily computed. When the cylinders were external to one another, it was proved that the three capacity coefficients were connected by two very simple relations. Limiting values between which these coefficients must lie were found, and methods of obtaining closely approximate values in special cases were given. Practically identical formulæ were given to find the current-density and the inductance coefficients with high-frequency currents, both for a cylinder inside a cylindrical tube and for two parallel cylinders. In the latter case it was shown that when the phase difference between the currents was less than 90°, the mechanical force between the cylinders was repulsive when they were close together, and attractive when they were far apart. At a definite distance apart, therefore, the cylinders, when carrying high-frequency currents, were in stable equilibrium. Since the potential coefficients could always be determined experimentally, it followed that the inductance coefficients for high-frequency currents, which were equal to them, were also found by the same experiments.

Institution of Electrical Engineers.—At a meeting of the Scottish Centre of the Institution, held in Glasgow on February 11th, Mr. P. Hunter-Brown read his paper on "Carbon Brushes: Considered in Relation to the Design and Operation of Electrical Machinery."

AUTOMATIC TELEPHONES.—The automatic telephone system now in operation at Leeds was described, last week, in a lecture at the Philosophical Hall, by Mr. T. B. Johnson, Post Office Superintending Engineer for the North-Eastern Division. Mr. Johnson told an interesting story of how the automatic switch came to be invented. In a description of the Leeds Exchange the lecturer said that the system was being watched with great interest by people all over the world. The city possessed not only the largest automatic exchange in Europe, but the largest in the world to be converted from the manual to the automatic system. The system had a capacity of 15,000 lines and an existing equipment of 6,800 lines, but it would permit of additional accommodation up to 100,000 lines. The lecture was illustrated by lantern slides, and a working model was used to demonstrate the working of the automatic system.

The National Association of Supervising Electricians.—The fifth annual general meeting of this Association was held on Tuesday last. The report of the Board of Control states that the present rate of application for membership exceeds all records, and the average attendance at meetings when technical papers were read during the past year exceeded 70. The Institution of Electrical Engineers invited the co-operation of the Association in solving some of the problems of reconstruction, and the Association has also assisted the Engineering Standards Association in connection with the standards for wall plugs and ceiling roses. The Illuminating Engineers' Society has offered the privilege of membership to members of the Association. Application has been made for recognition of the Association on the Joint Industrial Council, on which it obviously has a right to be represented, and every effort is being made to enrol all the supervisors in the country and to raise the status of the Association. The social activities of the Association are to be resumed, and an evening concert has been arranged for March 8th. The balance-sheet shows that the financial position is very satisfactory.

The Association, which was formed in 1914, and is registered as a Trade Union, has been conducted since the commencement on lines for which we have nothing but commendation; the membership is rigidly confined to men of British nationality, and the qualifications of candidates are strictly scrutinised; supervising engineers or managers must have had at least eight years' experience in the electrical trade, of which three years must have been spent as supervisors or managers, and foremen must be competent electricians who have been employed in the electrical trade for at least 12 years, during four of which they must have been recognised foremen. The objects of the Association are to obtain for members adequate remuneration, to regulate the relations between employers and workmen and between workmen and workmen, to obtain the best working conditions, to provide assistance for members in case of need, and to foster the apprenticeship system, and promote the technical edfication of electrical workers. Lectures and technical papers are read at the meetings, by eminent authorities, and social gatherings are also organised. As we showed in our last issue, the Association took an active part in frustrating the recent attempted strike, on the grounds that it was an organised attack on the principles of true Trade Unionism and contrary to the public interests. Now that organisation is in progress on every side, and it is almost indispensable for everyone engaged in industry to belong to some Association representing his particular interests, it is desirable that the existence and constitution of such a Society as this, which is founded on the firm ground of high principles and qualifications, and is conducted on admirable lines, should be widely known. The address of the Hon. Secretary (Mr. C. J. Banister) is 83, Deodar Road, S.W. 15.

Rochdale Strike Incident.—At Rochdale Police Court, last week, an echo was heard of a recent strike at the Corporation electricity works, when Thomas E. Cayton (34), was summoned at the instance of Mr. F. H. Rudd, borough electrical engineer, for feloniously and maliciously injuring an electric telpher, with intent to cut off the supply of electricity; and with hindering an employé from using certain ash carriages. It was stated that Cayton was employed at the works to drive an overhead telpher system, used for carrying ashes in skips to a hopper. On the 3rd inst. the ash wheelers came out on strike, and Cayton went down to the ash trench and overturned the carriages on which the ashes should have been placed. He threatened that if anyone attempted to clear the ashes away he would "lay them out." If the task of handling the ashes had been stopped, the whole of the works would have been brought to a standstill. Cayton and another man were seen to climb up to the telpher, and later it was found that three fuses had been taken out. The strike trouble had been caused by a few ash wheelers, the representatives of the men having agreed to working arrangements. Cayton said the trouble arose over the question of a 47-hour week. A fine of 20s. was imposed on one summons, and the other was withdrawn.

The Edinburgh Strike.—The members of the Edinburgh Branch of the Electrical Trades Union having decided to resume work after being on strike, a deputation interviewed the secretary of the Electrical Contractors' Association (Mr. W. Finlay, W.S.) to ascertain on what terms work might be resumed. These terms were that, so far as the employers could arrange, work would be resumed on Friday (February 14th). Mr. Finlay, in a letter, further stated that there would be no victimisation of men or apprentices because of the strike, but his Association would give no obligation that all former employés should be immediately employed, as, owing to the strike, a substantial amount of work had been driven to other districts, nor would it agree to give any preference to recent civilian employés as contrasted with former employés who were returning from the Forces, in regard to whom the members of the Association had already given definite obligations in addition to the general obligation, which was incumbent on every right thinking man. It was equally understood that there would be no boycotting of any individual employer on the part of the Union. In addition to other conditions, the Unions were asked to undertake that they would not be parties to any future strike without giving seven days' notice.

The Union intimated a partial acceptance of the conditions, but was to discuss minor points.

Appointments Vacant.—Shift engineer (91s.) for the Stalybridge, &c., Joint Tramways and Electricity Board; engineering master for the Wellington (Somerset) School; lecturer in electrical engineering (£250) for the East London College (University of London); assistant electrical engineer for the Gold Coast Government Railway (£350 + £80 duty allowance + £120 war bonus); assistant electrical engineer (£175) for the Buxton Corporation electricity department; meter tester for the Greenock Corporation electricity department. See our advertisement pages to-day.

Shell Detector.—A *Daily Mail* correspondent states that Prof. Gurron, of Nancy, has adapted Hughes's induction balance for detecting unexploded shells on farm land. The apparatus, which signals only large masses of metal, deals with 18 acres in about 20 hours.

"Safety First" Awards.—At a meeting of the London "Safety First" Council, last week, it was announced that Dr. Addison, President of the Local Government Board, and the Lord Mayor of London had become vice-presidents. A "Safety First" scholarship of 10 guineas, and 76 prizes of value £50, are offered to schoolchildren for essays on the prevention of traffic accidents. Two thousand drivers entered for the "Freedom from Accidents" competition, of whom 90 are to receive money prizes and badges. In addition, 457 first and 147 second-class badges are to be awarded. The first recipients of the Meritorious Service Award are Staff Foreman Henry Pilch, who pulled a man off the track at Westminster District Railway Station while a train was approaching; and H. Bedford, who averted a serious accident at the Port of London Docks by stopping a pair of bolting horses.—*The Times.*

Educational.—It is proposed to establish a technical institute at Coventry, at a cost of over £100,000. The manufacturers of the city are being invited to raise a separate fund of £50,000 to be spent mainly in equipment for trade instruction, and this fund has been started with a subscription of £5,000.—*The Times.*

Fatalities.—The death took place on Saturday of James Wright, a labourer employed at the Keighley Corporation tramway sheds, as the result of an accident at the works on the preceding Thursday. He told an Inspector that he had fallen down the stoke-hold of the heating apparatus. He was sent home, and became unconscious the same night. A doctor found a wound in the skull behind the right ear. He was suffering from concussion, and never regained consciousness.

A verdict of "Accidental death" was returned at an inquest concerning a fatality which occurred at the works of British Dyes, Ltd., Huddersfield. An apprentice aged 15 (F. Sykes) was helping to lay a lead-covered cable, and was passing it through a wall, when he received an electric shock. The cable passed over a live wire that went to another part of the works. The deceased was very eager to help, and his keenness to get on with the work was described as one of the contributory causes of the accident. The electrical superintendent (Mr. W. L. Ward), in giving evidence, said that he found that two small pieces of the insulation of the live wire had been snipped out, probably due to the lead-covering of the cable developing a sharp edge. There was also evidence of a flash caused by the contact of the electrified lead cable with two small pipes underneath.

NEW COMPANIES REGISTERED.

S. Pearson & Co. (Contracting Department), Ltd. (158,033).—Private company. Registered February 7th. Capital, £1,000,000 in £10 shares. To take over the business of contractors for public works carried on by S. Pearson & Son, Ltd., at 10, Victoria Street, S.W., or any parts or branches thereof, to construct, repair, administer or control railways, tramways, roads, tunnels, harbours, docks, slipways, shipping places, piers, jetties, wharves, staithes, quays, canals, reservoirs, tanks, oil wells and refineries, pipe mines, sewage, water, gas, electric light, and other works or conveniences, to carry on or assist in any commercial, financial, mining, oil, drilling, and industrial undertakings, &c. The subscribers (each with one share) are:—C. J. Newman, 12, Old Road West, Gravesend, secretary; S. R. F. Wickman, Wouldham, Tring Avenue, Ealing Common, incorporated accountant. First directors: Rt. Hon. Viscount Cowdray, Sir Clarendon G. Hyde, Sir Edward E. Pearson, Sir Ernest E. Moir, Bart., and Frederick T. Hopkinson. Solicitor: J. L. Walsh, 16, Finsbury Circus, E.C.

Ironclad Switchgear Co., Ltd. (153,023).—Private company. Registered February 7th. Capital, £4,000 in £1 shares. Electricians, electrical and general engineers, &c. The subscribers (each with one share) are: S. O. Ashworth, Rook Mount, Newchurch, near Manchester, slipper manufacturer; E. W. Morgan, 124, Manley Road, Whalley Range, Manchester, electrical engineer. First directors: S. O. Ashworth (permanent governing director), E. W. Morgan, and A. W. Ashworth. Registered office: 54, Corporation Street, Manchester.

Twiss Engineering & Electric Transmission, Ltd. (153,036).—Private company. Registered February 7th. Capital, £30,000 in £1 shares. Electrical and general engineers, and manufacturers of plant for the generation, accumulation, transmission, and supply of electrical energy, &c. The subscribers (each with one share) are: W. J. T. Monro, 28, Bishopsgate, E.C., member of Stock Exchange; A. J. Hall, 37, Blenheim Park Road, South Croydon, merchant. Subscribers appoint the directors.

Ernsmore Engineering Tool Co., Ltd. (153,052).—Private company. Registered February 8th. Capital, £2,000 in £1 shares. Engineers, tool makers, manufacturers of electric dynamos and apparatus, &c. The subscribers (each with one share) are: E. S. Moore, 2, Hungerhill Road, Nottingham, engineer; J. H. Rogers, 60, Robin Hood, Chase, Nottingham, engineer; H. Merchant, 134, Hungerhill Road, Nottingham, engineer. Subscribers appoint the directors. Solicitors: Hind & Godfrey, 15, Long Row, Nottingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Smith & Mortimer, Ltd.—Satisfaction in full on January 28th, 1919, of debenture dated May 25th, 1915, securing £350.

W. T. Henley's Telegraph Works Co., Ltd.—Charge on £67,331 War Bonds, dated December 31st, 1918, by way of substituted security. Supplemental to trust deeds of 1905 and 1911, securing £300,000 debenture stock.

Auxiliary Engineering Co., Ltd.—A notice of the appointment of S. F. Cuffe, of 42, Old Broad Street, E.C., as receiver, on January 27th, 1919, under powers contained in debenture dated July 31st, 1918.

Trafford Engineering Co., Ltd.—Mortgage dated January 22nd, 1919, to secure £6,000 and other moneys becoming due from the company to Hibernian Bank, Dublin, charged on land and premises at Barton-on-Irwell, Lancs.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramways Officials.—The Highways Committee of the L.C.C. recommends that Mr. J. J. McGregor, charge shift engineer, be appointed as from January 1st boiler-house superintendent at the Greenwich power station, at £300 per annum, plus the special temporary allowance of £50 per annum, in addition to the war bonus.

The Faversham T.C. has increased the salary of the electrical engineer, Mr. G. Sommerville, by £23 10s. a year as from September 1st last.

Kendal T.C. has advanced the salary of Mr. J. A. T. Barnes, electrical engineer and manager, to £300 a year, to date from April 1st last.

Carlisle Electricity Committee has appointed Mr. H. P. Baynham, station superintendent, to succeed Mr. J. H. Thompson as chief assistant at the electricity works, at £200 a year, rising £25 a year to £250, plus a war bonus of 35 per cent.

Wimbledon B.C. Electricity Committee reported that it had considered the claim made by the Associated Municipal Electrical Engineers under which the salary of the chief electrical engineer would be increased from £650 to £932 per annum. The committee decided not to accede to the claim, and the B.C. approved its action. The Committee has decided to refer the claim of the Electrical Power Engineers' Association concerning salaries to arbitration.

Lieut.-Colonel A. E. Mayes, lately returned from France, has resumed his duties as engineer and manager to the Isle of Wight Electric Light & Power Co., Ltd.

Stoke Newington B.C. General Purposes Committee recommends that £45 per annum additional war bonus be granted to Mr. H. Large, chief assistant and acting borough electrical engineer, as from October 1st, 1918; the present salary is £200 per annum, plus £15 war bonus.

General.—Mr. W. H. Mulhall, who joined the Royal Engineers on the outbreak of war, has now been demobilised, and has returned to the Edison Swan Electric Co., Ltd., in his old position as representative.

Roll of Honour.—We reproduce the following extract from the *Faraday House Journal*:—"Colonel Sparks (President, F.H.O.S.A.), who was appointed Assistant-Director of Labour to the Third Army in France in January, 1917, was soon appointed Commandant of Labour. Colonel Sparks had for a considerable time a very much larger number of men under his command than any Army Corps Commander in France. He was mentioned in Sir Douglas Haig's dispatches, and he has been made a Companion of the Order of St. Michael and St. George. It is interesting to remember that he was mobilised as a sergeant in the London Scottish on August 4th, 1914, and that he was wounded on December 21st, 1914. He has gained the M.C., the D.S.O., the Croix de Guerre (with palm), has been twice mentioned in dispatches, and has now been awarded the C.M.G. His war record is one in which all Faradians will take pride. Colonel Sparks has resumed his consulting work with his brother, Charles P. Sparks (Faradian, President I.E.E., 1915-17), at 66-71, Moorgate Court, Moorgate Street, E.C. 2."

Lieut. E. H. Dimmock, R.A.F., who was stationed at the Wireless Telephony School, Winton, Bournemouth, died on February 3rd from pneumonia.

Obituary.—Mr. P. F. Evans.—The death occurred on February 8th, from pneumonia, of Mr. Percy Francis Evans, for some years engineer with the Market Drayton Electric Light Co. He was 29 years of age.

Mr. E. O. Walker.—We regret to learn of the death of Mr. Ernest Octavius Walker, C.I.E., late of the Indian Telegraph Service. Mr. Walker passed away on February 12th at Kensington, from heart failure.

Mr. C. H. Stearn.—We regret to record the death, which occurred on the morning of February 14th, after a short illness, of Mr. Charles Henry Stearn, managing director of the Stearn Electric Lamp Co., Ltd. The deceased gentleman was the co-inventor with the late Sir Joseph Swan of the carbon-filament electric lamp. He was for some years managing director of the Swan Co., until its fusion with the Edison Co., into the Edison & Swan United Lamp Co., Ltd. On the expiration of the Swan patents he started the manufacture of electric lamps at Kew Gardens, and maintained an active part in the management up to the time of his illness. One of his inventions, the commercial success of which has been phenomenal, was the manufacture of artificial silk from viscose. The late Mr. Stearn was 75 years of age. The funeral took place at Richmond on Tuesday last.

Prof. G. Carey Foster.—The Institution of Electrical Engineers was represented at the funeral of Prof. George Carey Foster, LL.D., B.Sc., F.R.S. (past president, and one of the original members of the Institution), by the following: Sir R. T. Glazebrook, C.B., F.R.S., past president (also representing the president of the Institution); Mr. Alexander Siemens, past president; Mr. W. M. Mordey, past president; Mr. Walter Judd, member of Council, and Mr. R. H. Tree, chief clerk.

CITY NOTES.

Crompton & Co., Ltd.

At the meeting held on Friday last at Salisbury House, E.C., Mr. A. A. Campbell Swinton, F.R.S., who presided, said that the reason he was now chairman in place of Mr. Tufnell was because the board, having regard to the general conditions obtaining in the electrical industry, thought it might be in the interests of the company to have someone in the chair who had been associated, as he had been, with the technical side of the industry. Mr. Tufnell still remained on the board. The last time the directors presented accounts was in July, 1916. Meetings of shareholders were held in 1917 and 1918, and dividends were paid in respect of both those years, but no accounts were presented. As was then explained, certain matters arising out of the control of the company under the Munitions of War Act had to be settled before the accounts could be published. Although the company's liabilities for excess profits tax for the years 1916-17 and 18 had even now not been definitely ascertained, some progress had been made towards their settlement, and other questions concerning the accounts had also been settled. They were now able to submit accounts for the three years up to March 31st, 1918. At the meeting in July, 1916, the directors recommended that £10,000 should be placed to depreciation reserve. The additional depreciation which they had now been allowed to charge, and the arrangements made with the Ministry of Munitions in regard to certain items of capital expenditure now made that reserve unnecessary. The net profit for the three years had amounted to £114,268, or an average of £38,089 per annum. The rate of profit earned during the three years had, year by year, shown a steady increase. In the balance sheet the freehold land and premises stood at a rather lower figure than in March, 1916. The stock in trade had increased from £80,000 to £155,000—very nearly double, and after allowing for the increased costs, was some indication of the growth of the business. Investments had been increased by £2,500. In a company such as theirs, whose pre-war profits were not large, the special war taxation was a heavy drain upon their resources. Money that would otherwise have been used to improve their works and generally to increase their cash reserve had been taken by the Government. It was sincerely to be hoped, not only in their individual interests, but in the interests of industry generally, that the excess profits duty would soon be abolished, or at any event greatly reduced. It was a millstone round the neck of industry and enterprise, and unless removed would do more to prevent the re-employment of our demobilised soldiers than anything else. The imposition of the tax originally was part of a bargain made by the trade unions, and when first applied it had a certain amount of moral sanction, inasmuch as it was not considered right that while one part of the community should make great sacrifices, another portion should be making profits out of the war. Such moral sanction, however, had now ceased to exist, and the duty, if continued, would seriously hamper the development and expansion of industry. The Federation of British Industries, of which the company was a member, was taking the matter in hand, and was doing its best to press the question upon the attention of the Government. With regard to the future, the profits for the current year, so far as they had been ascertained, were good, and they looked forward to being able to show very satisfactory figures at the next annual meeting in July. Proceeding to refer to the proposals in the report for additional capital, the chairman said the directors felt it was essential that the capital should be increased in order to cope with the new business that was now offering itself every day. During the last four years of war, practically all manufacture of electrical machinery for ordinary purposes had been arrested, and there had also been practically an entire cessation of export, both to foreign countries and to the Colonies and India. The consequence was that an enormous amount of demand for electrical plant throughout the world had accumulated, and the company was simply inundated with work, which required capital to carry it out. The demand for electrical plant was intensified by the great demand that was now taking place for labour-saving appliances, most of which had to be driven by electric motors. There were, too, the new proposals of the Government for the development of electric power on a very large scale throughout the country by means of the proposed super-power stations, by which it was hoped to be able to enormously increase the use of electrical energy for power purposes in every part of the United Kingdom. That in itself would produce a further great demand for electric motors and other appliances, so he did not think there could be any doubt but that the market for the kind of things they made at Chelmsford was likely to be very considerable, at any rate for many years to come. Again, there was a great demand abroad, in France and Belgium, where a great part of the electrical machinery had been destroyed, and neither of those countries was in a position to renew it. In addition to that, various neutral countries had made a great deal of money during the war, with the consequence that they had got a good deal to spend, and they were intending to spend a considerable portion of it in electrical machinery. The directors' proposals involved the creation of £24,000 of additional preference shares and £254,993 ordinary. It was proposed to reserve the preference shares to be issued to the company's employés. The directors had very carefully considered the matter, and thought it would be in the general interests of the company to give the employés a direct interest in the profits. They proposed to issue those shares both to the workpeople and the staff on a plan whereby they would be able to purchase them by a certain sum being deducted weekly from their wages. Not only would there be a 7 per cent. preference, but as soon as the ordinary received 7 per cent., further profits would be divided equally between the two classes of shares. In addition, they had thought well in the case of preference shares issued to the employés to give an additional 3 per cent., so long as the shares were held by the employés. They had thought it necessary in the first instance to limit the amount that any one employé might apply for. They heard a great deal nowadays of industrial unrest, and the directors thought that was one way of meeting it. The amount that a company such as theirs distributed in the way of dividends was only a very small proportion of what it paid its workpeople as wages. If all the profits were paid over to the workmen it would only mean a shilling or two extra a week, and, of course, in such an event they would never be able to raise more capital. It was a common belief among workmen that there were only what they termed capitalists and workers; but taking that company, they had no less than 700 shareholders, and the average dividend received by them was under £20. The board had not yet decided when they would issue the ordinary shares, but the shareholders would be given an opportunity to subscribe for them. At the meeting in July, 1917, a shareholder proposed a resolution to increase the directors' fees, but the chairman pointed out that such a resolution was out of order, as the fees were fixed by the articles and could only be altered by special resolution. The directors now proposed to alter the articles so as to provide for an increase of £100 a year to each director.

Mr. C. Tufnell seconded the motion.

Replying to questions, the chairman said that the extra 3 per cent. on the preference shares to be issued to the employés would be a bargain between the company and the individual holder, and the 3 per cent. would be a first charge upon the company's profits.

The report was adopted.

Subsequently resolutions were passed increasing the capital of the company and altering the articles of association.

The London Underground Railways.

Reports have been issued by the five companies that are parties to the common fund agreement, and we extract the chief particulars below. The aggregate gross traffic receipts of the five concerns were £6,884,715, and the aggregate gross receipts were £7,743,451. The aggregate amount retained by the five companies as defined by the common fund agreement, which includes working expenses, prior charges, reserves, and other items of a similar nature, was £7,111,760. The balance, £631,690, was credited to the common fund, and is divided as shown below. The aggregate number of passengers carried by the concerns is estimated at 901,000,000, exclusive of through inwards passengers to the Metropolitan-District from other controlled railways.

City & South London Railway Co.—This company is entitled to 6 per cent. of the common fund (£631,690). It accordingly receives £37,901 for 1918. This company's total net income was £152,404 plus £21,226 brought forward. Interest, rentals, and other fixed charges absorb £47,003, and £25,000 is appropriated to reserve, £42,000 to preference dividend, and after paying the dividends on the ordinary stock, mentioned in our last issue, a further £5,000 is put to reserve. Capital expended during the year £33,612. Despite shortage of staff and other difficulties, the traffic carried constituted a record. Arrangements are in hand for the purchase of new and larger cars, and the work of enlarging the tunnels will shortly be recommenced. A late Bill is to be deposited in Parliament for raising additional capital to meet the contemplated expenditure. It is hoped that all restrictions imposed for conserving coal used in electrical generation will shortly be removed. An arrangement has been made between this company, the London Electric Railway Co., and the Central London, whereby the London Electric Railway Co. bears all the expenses of maintaining and operating the three railways, recognising advances of moneys from time to time as necessary. At the close of each year the total expenses are allocated on an agreed statistical basis. It is thus possible to deal with the maintenance and operation of the three tube railways as if in fact there were one railway, and considerable economies in the keeping of accounts are being effected.

Metropolitan District Railway Co.—This company is entitled to receive 12 per cent. of the common fund, namely, £75,803. The company's total net income was £583,703 plus £29,029 brought forward. Interest, rentals, and other fixed charges absorb £347,971. £35,000 is put to reserve, dividends on guaranteed and first preference stock required £124,930. After paying the dividends mentioned here last week a further £10,000 is put to reserve, and £21,331 is carried forward.

Central London Railway Co.—This company is entitled to receive 20 per cent. of the common fund, namely, £126,338.

The total net income was £227,571, plus £11,147 brought forward. Interest, rentals, and other fixed charges absorb £59,633, there is appropriated to reserve £20,000, dividend on preference stock £21,600, and after paying the dividends on other classes of stock as stated here last week, £17,485 is to be carried forward.

London Electric Railway Co.—This company is entitled to receive 30 per cent. of the common fund, namely, £189,507. The total net income was £650,604, plus £30,656 brought forward. Interest, rentals, and other fixed charges were £299,150, £35,000 was put to reserve, dividend on preference stock required £126,947, and after paying the dividends mentioned here last week, a further £10,000 was put to reserve, leaving £23,604 to carry forward. It is proposed to proceed at an early date with improvements which were postponed by the war, and a late Bill in Parliament will seek powers to raise capital necessary for the purpose.

London General Omnibus Co., Ltd.—This company is entitled to receive 32 per cent. of the common fund, namely, £202,141.

Dublin United (Electric) Tramways Co., Ltd.

Mr. W. M. Murphy, presiding at the meeting last week, said there had been no expenditure during the year on capital account; but further capital expenditure would be necessary to improve the electrical distribution system, and to meet the problem which had arisen owing to the increased and increasing volume of electricity which the main cables would be called upon to convey. It was proposed to erect a central sub-station, with machines effecting a considerable saving in power to be generated, and a site had been obtained from the authorities of Trinity College at the junction of College Street and Brunswick Street. The saving of coal by the proposed installation would more than pay the interest on the outlay, which would amount to £10,000. They had record figures both in receipts and expenditure, the increase in the former being roughly £90,000, and in the latter just under £70,000. The coal bill, on a rationed supply, reached £38,906, an increase of £8,580, and the whole cost of station operation, £47,106, showed an increase of £10,634, as compared with 1917. The total maintenance cost had increased by £30,542, which was mostly in wages. There was an increase in traffic expenses of £18,847. He believed theirs was the last undertaking of its kind in the kingdom that had increased its fares. On the question of continuance of increased passenger traffic, he would not forecast an opinion, but he was afraid they were living through a period of artificial prosperity, which must necessarily be of a temporary character, as it was due to the lavish expenditure of some of the thousands of millions borrowed from the State. This could not go on for ever, and he feared sooner or later they would have a rude awakening to the perception of the elementary principles which must ultimately govern the finance of the world.

National Electric Supply Co., Ltd.—The annual meeting was held at Preston last week. Mr. Booth, who presided, said that the restrictions imposed upon consumers and the company had seriously affected the income, but the directors felt that the worst period of depression had passed, though it might be some months before matters became normal. Increased wages and advances in the cost of materials had compelled an increase in the price of current. Only £817 had been spent on capital account, and over £4,000 on repairs and maintenance. It was proposed to place £5,000 to reserve for depreciation, &c. The cost of fuel, £10,858, was an increase of £2,232, and salaries and wages were £6,211, as against £4,561 last year. The two increases were equal to an additional 7 per cent. on the ordinary shares. Notwithstanding the restrictions they had sold 86,191 more units than last year, and the income had increased by £3,751. Regarding the Government proposals as to the erection of super-stations, they believed the scheme would go through. Everything would be done to protect their interests.

South Metropolitan Electric Light & Power Co., Ltd.—The accounts for 1918 show a credit balance of £63,387, plus £7,626 brought forward. After deducting £14,986 for debenture and other interest, and £7,895 for interim dividends paid on the pref. shares, it is proposed to pay a final dividend upon the 7 per cent. cum. first, and the 6 per cent. cum. second pref. shares, to put £20,000 to depreciation fund, to pay 6 per cent., less income-tax, on the ordinary shares, and to carry forward £12,857. The revenue account shows a satisfactory improvement, and the return from sales of current has increased. Notwithstanding a substantial rise in the cost of coal, wages, &c., the business has been well maintained. The installation of a third 5,000-kw. turbo-alternator and auxiliary plant is proceeding. The undertaking of the West Kent Electric Co., Ltd., has made further progress, and a dividend of 10 per cent. has again been recommended. Annual meeting: February 26th.

Prospectus.—*International Light and Power Co., Ltd.*—The list is to close on or before to-morrow in an offer for sale of £396,200 5 per cent. first mortgage debentures, of which £200,000 have been applied for and allotted in full. The debentures are offered by the Law Debenture Corporation, Ltd., on behalf of itself and others at £75 10s. per £100 debenture.

Lancashire United Tramways, Ltd.—The report for 1918 shows: Traffic receipts, £160,867; electrical energy sold and miscellaneous receipts, £21,174; less working expenses, £91,242; cost of generating electrical energy sold, £14,586; general charges (including direction, management, &c.), £6,647; rent of leased lines, £5,191; add dividend on holding in New St. Helens and District Tramways Co., Ltd., £3,068; profit of combined undertaking, £67,443. Receipts, compared with those of previous year, show an increase of £40,827, traffic earnings per car mile amounting to 17.85d. Increase in expenditure amounted to £25,925. The interest and dividends received by the company from the operating companies, together with sundry receipts, amounted to £19,973. After deducting interest on the prior lien debenture stock and expenses, there remains a balance out of which the full interest of 5 per cent., less tax, will be paid on the second mortgages debenture stock for the year 1918. The sum of £7 remaining is carried to depreciation account.—*Financier.*

Smithfield Markets Electric Supply Co., Ltd.—The gross profit for 1918 was £470, against £2,268 in 1917, and the net loss for the year was £1,749. £400 has been placed to the debenture stock redemption fund, and the balance of "Alteration of Pressure" account, £558, has been written off. After crediting £1,214 brought in from last year there is a debit at profit and loss account of £535. Owing to official control of the Central Markets and the closing of many buildings, there has been a serious reduction in the company's output, while the abnormal cost of fuel and materials, and higher wages and war bonuses have further adversely affected the profit. It is hoped that there will be a gradual improvement during 1919.

Electrical Distribution of Yorkshire, Ltd.—The net profit for 1918 was £3,168, as against £3,495 for 1916 and £3,693 for 1917. Adding £583 brought forward, £3,751 is available. A dividend at the rate of 6 per cent. per annum, free of income-tax, on the ordinary shares absorbs £2,738, leaving £1,012 to carry forward, subject to directors' remuneration. The difficulties of the year have prevented steady expansion, have increased costs, and have reduced the profit. Many demands for supply are now being made. The end of hostilities is permitting the gradual release of labour and material, and considerable extensions of mains must be made. Further capital is thus required. A resolution was passed a year ago increasing the nominal capital from £50,000 to £100,000.

St. James' & Pall Mall Electric Light Co., Ltd.—The connections increased during 1918 from 17,253 kw. to 18,114 kw., and 10,593,556 units were supplied to consumers. The net profits were £26,290, plus £5,286 brought forward. The dividends of 7 per cent. on the preference shares and a total of 10 per cent. per annum on the ordinary leave £4,576 to be carried forward. The units generated by steam plant were 341,639, and those purchased 13,600,079. For private supply 10,593,556 were sold; used on works 235,300; on batteries 193,446; transmission and transformation 2,455,121; distribution 464,286. Annual meeting, February 25th.

Westminster Electric Supply Corporation, Ltd.—The total connections increased during 1918 from 48,084 kw. to 50,166 kw. Lt.-Col. Sir James Remnant, M.P., has retired from the board, and Lord Downham of Fulham has been elected. After allowing for depreciation, sinking fund and other charges, and paying the preference dividend, a dividend at the rate of 9 per cent. per annum, less tax, is to be paid for the last half-year, making 8 per cent. for the year. £5,693 is to be carried forward. Units sold, 25,211,780, including 1,317,709 A.C. supply; used on works, 277,790. Annual meeting: February 26th.

Fife Tramway, Light & Power Co.—The directors report a profit for the year, after paying the interest and debenture redemption instalment, of £38,635, and recommend a dividend on the ordinary shares of 7 per cent., less tax, besides transferring £15,000 to the reserve account. They state that the abnormal costs affected the revenue from the power, lighting, and tramway properties adversely, but the result of the year's trading is regarded as satisfactory. The tramway to Rosyth has proved a very satisfactory addition to the company's system.

National Gas Engine Co., Ltd.—The net profit for 1918, after providing for depreciation, management salaries, excess profits duty and income-tax, is £104,012. Interim dividends of 5 per cent. per annum on the pref. and 7½ per cent. per annum on the ordinary have already been paid, and final dividends of the same amounts, both less tax, are now to be paid, together with a bonus of 1s. per share, free of tax, on the ordinary shares. £78,132 is to be carried forward.

Stock Exchange Notices.—The following have been ordered to be quoted in the Official List:—

Buenos Ayres Lacroze Tramways Co., Ltd.—£65,400 additional 5 per cent. consolidated mortgage debentures of £100 each (Nos. 10,001 to 10,600 and 10,661 to 10,714).

Morgan Crucible Co., Ltd.—Scrip for £500,000 6 per cent. first mortgage redeemable debentures.

Central Electric Supply Co., Ltd.—During 1918, 30,163,906 units were supplied to the Westminster Electric Supply Corporation, Ltd., the St. James' & Pall Mall Co., and the Chelsea Electricity Supply Co.

Vera Cruz Electric Light, Power & Traction, Ltd.—Mr. V. W. Yorke, presiding at the annual meeting last week, said that not only had they been able to resume payment of dividends, as he had anticipated at the last meeting, but they were able to recommend for 1917 the highest dividend in the history of the company. This had come about through the steadiness of the exchange all through the year under review, and the fact that there were no disturbances of the peace in Vera Cruz, and because the transmission line from Tuxpango, 70 miles long, suffered no serious damage. The profits for 1918 had not been quite so good, and the result was that the net earnings for the 10 months to the end of October showed a decrease of some 80,000 pesos. Construction of the tramway to Balncarios, which was commenced in August, had now been suspended for want of the necessary rails. Conditions in Mexico showed little, if any, improvement, but the termination of hostilities in Europe would bring the permanent settlement of the country appreciably nearer. Public utility companies such as theirs had suffered very little material damage during the whole revolutionary period. In a few outlying districts transmission lines had been destroyed, but generating plants had escaped damage.

Clontarf (Dublin) & Hill of Howth (Electric) Tramway Co., Ltd.—At the meeting held at Dublin, Capt. W. L. Murphy presiding, the directors' report was adopted, and a dividend at the rate of 3 per cent. per annum, less income-tax, was approved.

Mather & Platt, Ltd.—The dividend for 1918 on the ordinary shares is at the rate of 17½ per cent. per annum, free of tax.

Liverpool Overhead Railway Co.—Dividend on the ordinary shares for 1918, 3¼ per cent., leaving £6,120 to carry forward.

Held Over.—Owing to pressure upon our space, several City and other matters are held over until next week.

STOCKS AND SHARES.

TUESDAY EVENING.

MEXICAN securities are the outstanding feature of strength in Stock Exchange markets, which otherwise have been somewhat dull. The Labour position is making investors thoroughly uneasy. People say they will not put money into shares of domestic industries. The provincial centres continue to support their local companies, and this helps to keep industrial prices steady. But there is noticeable disinclination on the part of the ordinary buyer to pay heed to home shares, and the tendency is underlined by the willingness shown to embark money in ventures outside the strike area of our own shores.

Accordingly, the dramatic turn for the better taken by the Mexican situation has found a ready welcome waiting for it, and Mexican prices, advanced all round, are still better than they appear. Hardly any supply of stock was afloat, and what there was the early buyers quickly absorbed. Bonds in the Mexican utility companies are one to three points higher. Private advices are quoted as evidence that Mexico is in a much better way than most people suppose. After the past six years of chaos, mob-rule, currency depreciation, and interest suspensions, it is hard to believe that any good thing, save oil and minerals, can come out of Mexico. Physical deterioration of plant on railway and industrial undertakings must have made severe ravages upon capacity for immediate prosperity, yet at last week's meeting of the Vera Cruz Tramways Co. the chairman produced surprising testimony to the value, *e.g.*, of the Mexican dollar, and to the prospect of better times ahead.

Doubtless Mexico has many a long and dreary furrow to hoe before good times come again, but the outlook seems sufficiently promising to encourage proprietors of Mexican securities to hold their stock.

Other foreigners are flabby. The Argentine Labour leaders are taking leaves from the books of others nearer home, and, in consequence, the various Plate concerns remain out of favour. Brazilian Tractions continue to be a sagging market. No improvement has occurred to change the recent dulness of British Columbia Electric Railway issues. Only in the Mexicans is there any brightness noticeable.

The Home Railway list is equally heavy. All the dividend announcements are out, most of the reports too, and several meetings have been held. The Great Northern chairman declared that the wages increase since the outbreak of war was enough to wipe out all dividend earnings, including those of the preference and debenture stocks. This made Home Rails weak to flat. The Undergrounds shares in the malaise, Districts, Metropolitans, Underground Incomes, and several prior-charge descriptions have fallen from ½ to 1½ points. Nationalisation is no longer a word to conjure with. The public are afraid of Home Rails, refuse to touch them—except to sell the stocks to a market reluctant to add more to its present load.

Movements in the telegraph list are small and unimportant. Business is inactive, and there is nothing of fresh interest to kindle attention. Even amongst Marconis business is very quiet, and the same condition applies to shares in the telegraph manufacturing companies, as well as those in the cable group. As the date approaches for the introduction of the Budget, public speculation begins to revolve round the question of income-tax, but the chances of any relief in this direction are considered sufficiently remote to make the holding of cable stocks still worth while in those cases where dividends are paid free of deduction. West India and Panama ordinary have risen a little. Telegraph Constructions strengthened to 49. Siemens at 6¼ have gained half-a-crown.

The electric lighting market is also quiet. Wednesday this week was the last day for sending in applications for the new issue of Westminster Electrics, and allotment letters changed hands freely on the basis of 5s. 9d. premium up to Tuesday. This, making all allowances, is a little lower than the price for the existing shares, which seems to indicate that a majority of proprietors were willing to take the premium on the new issue as a little present, or extra dividend. In time, the shares will rank on all fours with their seniors. Electric Constructions have risen to 1½, and British Aluminiums to 38s. 3d., but otherwise the manufacturing list has scarcely varied. An interesting new issue is that of the International Light & Power Co. The Law Debenture Corporation, Ltd., offered for sale—the list closing on or before Saturday this week—396,200 5 per cent. first mortgage debentures of £100 each at 75½ per cent. The Corporation bought the debentures at 70, but pays 3 per cent. underwriting commission and certain other expenses. The company's fields of operation are in Venezuela, the Argentine, and Mexico, and, having regard to this, it is obvious that a speculative element attaches to the bonds, which pay a trifle over 6½ per cent. on the money.

Castner-Kellners have gone back ½, other chemicals also being dull. The rubber share market has taken on a better tone. Base metals are mostly dull, on the drop in the price of tin. The armament group retains a fair degree of strength.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Feb. 18, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	9	10	7⅞	—	£6 15 7
Charing Cross Ordinary	5	4	3⅜	—	5 10 4
do. do. do. 4½ Pref.	4½	4½	8⅜xd	—	6 18 4
Chelsea	3	5	4	—	6 5 4
City of London	8	8	12⅜	— ⅛	6 6 9
do. do. 6 per cen Pref.	6	6	10½	—	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
Kensington Ordinary	6	7	6	—	5 16 8
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	3	4	3	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	7½	—	6 4 2
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6⅞	— ⅛	6 13 4
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	98½	—	£6 1 10
do. Def.	1½	1½	21⅞	— ⅛	7 13 0
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10⅜	—	*6 10 4
Eastern Extension	8	8	15½	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14½	—	*4 19 1
do. do. Pref.	6	6	10½	—	5 14 8
Great Northern Tel.	24	22	32	—	6 17 6
Indo-European	13	13	58	—	5 12 0
Marconi	15	20	42	—	4 6 7
Oriental Telephone Ord.	10	10	2½	—	4 0 0
United R. Plate Tel.	8	8	7⅞	—	*5 1 7
West India and Panama	6d.	1/3	1⅛	+ 1/16	*3 14 6
Western Telegraph	8	8	16⅜	—	*4 16 3
HOME RAILS.					
Central London Ord. Assented	4	4·	65¼	—	6 2 2
Metropolitan	—	1	28½	—1½	4 7 9
do. District	Nil	Nil	26	—1½	Nil
Underground Electric Ordinary	Nil	Nil	3½	—	Nil
do. do. "A"	Nil	Nil	10/-	—6d.	Nil
do. do. Income	6	4	95	—1	*5 5 2
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	42	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅛	—	—
do. do. 2nd Pref.	5½	—	3½	—	—
do. do. 5 Deb.	5	5	71½	—	6 19 10
Brazil Tractions	—	—	54	—1½	—
Bombay Electric Pref.	6	6	103	—	5 11 7
British Columbia Elec. Rly. Pfcs.	5	5	65½	—	7 12 8
do. do. Preferred	Nil	Nil	46	—1	Nil
do. do. Deferred	Nil	Nil	42	—1½	Nil
do. do. Deb.	4½	4½	62	—	6 17 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	64	+ ½	Nil
do. 6 per cent. Bonds	Nil	Nil	58½	+2½	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	50	—	Nil
do. 1st Bonds	Nil	Nil	66½	+1	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3⅝	—	3 17 5
British Aluminium Ord.	10	10	38/3	+2/-	5 4 5
British Insulated Ord.	20	20	2⅜	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅜	—	6 0 0
Callenders	20	25	10½	—	5 16 3
do. 6½ Pref.	5	5	5⅜	—	5 2 4
Castner-Kellner	22	20	3⅞	— ½	6 1 3
Edison-Swan, "A"	—	—	16/9	+3d.	—
do. do. 4 per cent. Deb.	4	4	74½	—	5 6 0
Electric Construction	7½	10	1½	+ 1/8	8 0 0
Gen. Elec. Pref.	6	6	10½	—	6 6 10
do. Ord.	10	10	17⅜	—	*5 14 3
Henley	25	25	2 1/16	—	5 8 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord.	10	—	6¼	+ ¼	*3 0 0
Telegraph Con.	20	20	49	+ ½	*4 17 0

* Dividends paid free of Income Tax.

THE FUNCTIONS OF THE ENGINEER: HIS EDUCATION AND TRAINING.

By Bt.-Lieut.-Colonel W. A. J. O'Meara, C.M.G., M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

Unfortunately, an opinion has prevailed in this country in the past that the problems which present themselves in a technical undertaking fall under two independent heads, namely, the "technical" and the "administrative"; it has been assumed that the "technical" problems of an undertaking alone constitute the domain of the economics of practice, whilst the consideration of every other problem, financial, commercial, or administrative, belongs exclusively to the realm of the economics of policy. The consequence is that schemes prepared in connection with the education and training of the engineer have hitherto been framed for the purpose of meeting this condition of affairs. In some foreign countries a wider view has been taken than has been the case in this country, and it has been suggested that the instruction given to engineering students during the normal college course should include such subjects as accountancy and book-keeping, banking, mercantile law, political economy, repairs and depreciation, sociology, &c., and in some of the American institutes of technology, a department of "business engineering" has existed for very many years. The American engineer occupies, as a rule, a far stronger and a much more important position in the economics of industrial and commercial life than that accorded to his confrère in this country. The same is true as regards the position of the engineer in many of the countries on the continent of Europe. The Société des Ingénieurs Civils de France, last year, passed a resolution recommending that instruction in administrative subjects should forthwith be made obligatory for all students attending courses of instruction in the higher schools of civil engineering in France. The scheme of education provided for the engineering student in this country should aim at covering as wide a field as that covered in similar cases in any other country, in order that the British engineer may properly discharge the whole of the duties which may devolve upon him, and may be qualified for the wide responsibilities likely to fall upon his shoulders. The specialised education and training of the engineering student should be designed with a view to qualify him to fill, with the highest efficiency, the functions of the position in which he will find himself on obtaining his first responsible appointment after the termination of his complete course of instruction.

The greater part of the work that the engineer is called upon to deal with to-day consists in the construction of works and in the development and exploitation of enterprises which require the provision and maintenance of machinery and plant, the essence of a great part whereof is motion and in every part whereof expansion, progress, and growth are the predestined concomitants. These enterprises present not only technical problems of great complexity requiring solution, but also the equally important commercial and administrative problems relating to running costs, repairs, and depreciation, capital outlay *in futuro*, as well as *in præsenti*, the organisation of the undertaking and the personnel connected therewith, the control and management of the staff, &c. What knowledge other than that comprised in the normal college course is it necessary to call in aid in order successfully to grapple with the scheme as a whole and to see it through to completion?

Monsieur Henri Fayol, a distinguished French engineer, in 1917, pointed out that as a matter of fact the several operations connected with every enterprise fall into six distinct groups, namely:—

(i) The Financial.
(ii) The Commercial.
(iii) The Technical.
(iv) That of Custodianship.
(v) That of Book-keeping.
(vi) The Administrative.

The responsible engineer in every undertaking must be concerned in his professional work with every one of these groups or essential functions.

In order to demonstrate what is comprised within the ambit of each of the six functions in question, the author has collected a number of items or transactions, and has classified them in a table, each item or transaction being placed under its appropriate group or function. To-day, even in the organisation of the largest undertakings, the division of responsibilities is unavoidably so arranged, that every member of the controlling staff must concern himself with at least three of the six groups of functions.

The very important part administration plays in promoting success in the conduct and operations of undertakings of every kind is widely recognised; and therefore some knowledge of the principles involved in the science and art of administration is essential to everyone forming a link in the chain of organisation of commercial and industrial undertakings.

An attempt has been made by the author to estimate approximately the nature of the qualifications needed by certain officials in two engineering undertakings of different types; the information is tabulated in Appendix I. The figures bring into prominence the fact that the technical faculty by no means constitutes the qualification of the highest importance in those who reach the higher ranks of the engineering profession; further, it will be observed that the engineer must in many positions possess to some extent all six faculties.

Even in the case of the foreman the possession of the technical faculty alone is insufficient, very highly developed though it may be; he also must have developed in him faculties of other kinds if he is to fill his position with credit to himself and economy to the undertaking in which he is employed.

Of course, the 100 per cent. of the foreman's total capacity is as a rule something vastly different from the 100 per cent. of the capacity of those in the grades higher than his own; and the 45 per cent. of the assistant power engineer's technical faculty may be equal or even superior to the 82½ per cent. of the charge shift engineer's technical faculty.

In the same way that those responsible for the highly technical work of an undertaking must possess some measure of administrative talent, successfully to handle the problems falling within their proper sphere, so must those who are responsible for the management aspect of modern commercial or industrial undertakings possess some measure of technical knowledge to enable them to exercise their full responsibilities with efficiency and skill.

Diagrams have been prepared (fig. 1), in relation to one of the undertakings concerning which particulars are given in an appendix I, in which the verticals are divided so as to correspond with the percentage figures, whilst the horizontals have been drawn proportionate in length to the salaries and wages appertaining to the several positions in the organisation. The higher the ratio of the administrative faculty needed in any particular position, the greater as a rule is the remuneration attached to that position.

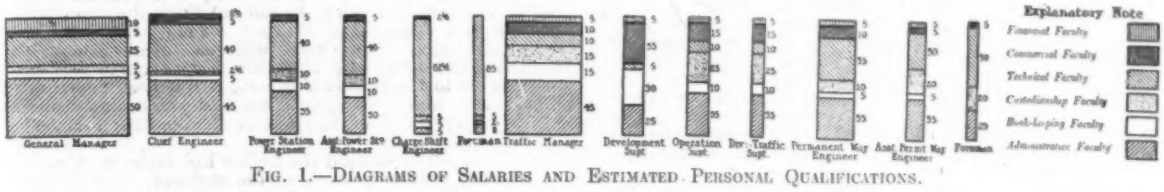

Fig. 1.—Diagrams of Salaries and Estimated Personal Qualifications.

The author suggests that steps should be taken to revise without delay the curricula of engineering courses, in order that a wider scope should be provided in the instruction given therein, so that the engineer, on entering upon the active pursuit of his career, may be better equipped than at present properly and efficiently to perform his professional duties from the administrative and commercial points of view as well as the technical.

It may be urged that no time can be allotted in the curricula of the present engineering courses; that commercial and administrative subjects cannot be taught by lectures; that such subjects are proper matters for treatment in graduate lectures; or that the engineer's employer is the best-qualified person to impart instruction to him in commercial and administrative subjects. These objections do not constitute a sufficient argument for the retention of the present schemes. The matter of finding time is solely a question of willingness to view the various aspects of the engineer's responsibilities and work in their true perspective. Those who may argue that commercial and administrative subjects cannot be taught by lectures, are invited to examine and consider the means that have been adopted at our universities and other institutions in order to assist young men to qualify themselves for positions connected with the administrative posts in the public service. A knowledge of commercial and administrative subjects can be acquired by every engineering student sufficient to enable him to carry on until experience comes to his aid.

The argument that instruction in commercial and administrative subjects is a matter exclusively for graduate lectures is really untenable, and employers are rarely in a position to afford to their employés instruction in commercial and administrative subjects systematically, even should they be willing to undertake the responsibility, which is extremely doubtful. There is a tendency on the part of many engineering students to despise the administrative and commercial aspects of engineering work and to consider the same unworthy of their attention. Therein lies a serious danger, unless some instruction is given in the subjects in question during the college course.

It is the author's opinion that the preliminary instruction

in commercial and administrative subjects in engineering courses should extend at least to the numbers of hours stated below, and should cover the elements of the following subjects:—

Subjects.	Number of Hours' Instruction.
(*a*) Accountancy and book-keeping	8
(*b*) Administration and organisation	8
(*c*) Commercial law	6
(*d*) Depreciation	2
(*e*) Estimating and writing of specifications	12
Total number of hours' instruction during course	36

A brief outline is given in an appendix of the scope of the preliminary instruction in the above subjects which, it is recommended, should be given, and a short list of works dealing with commercial and administrative subjects has also been prepared. The ideal method of teaching engineering would be always to give the instruction in the practice and the theory simultaneously. In the United States of America in connection with the so-called "co-operative system," the courses are so arranged that the students spend, first, one week at the works of a manufacturing undertaking, and the next week in the college, this weekly alternation of practical and theoretical work being kept up during the whole period of the engineering course. The "co-operative system" is but a highly developed form of the "sandwich system" introduced some years ago into this country. It appears to be desirable, certainly in the case of the engineering schools and colleges situated in the great industrial centres, that a very considerable effort should be made to introduce "co-operative courses" into this country.

In many branches of engineering systematic practical training in the workshop is as indispensable to the student as the regular instruction in the engineering subjects given in schools and colleges. Some manufacturing firms have adopted the very wise and patriotic policy of receiving as pupils young men, who have been suitably educated for the engineering profession, into their workshops without the payment of a premium. If this policy be adopted universally by all manufacturing firms throughout the British Isles, it would prove of incalculable advantage to British industry. Engineering students must, whilst studying technology, be encouraged to improve their general education by widening their knowledge of the world and its affairs and by the study of foreign languages. One of the most important qualifications needed in a modern engineer consists in a command of the English language, and a facility to give expression to his thoughts through its medium with clearness, conciseness, and completeness, in speech as well as on paper. Great issues, involving considerable sums of money, sometimes depend upon the choice that is made of particular words and their collocation in a record.

APPENDIX I.

Estimate of Qualifications Needed by Certain Grades of Officials in Two Types of Particular Engineering Undertakings.

Grade.	Faculties. Financial.	Commercial.	Technical.	Custodianship.	Book-keeping.	Administrative.
Tramway Undertaking.	%	%	%	%	%	%
General manager ...	10	5	25	5	5	50
Chief engineer	2½	5	40	2½	5	45
Power station engineer ...	—	5	40	10	10	35
Assistant p.s. engineer ...	—	5	45	10	10	30
Charge shift engineer ...	—	2½	82½	5	5	5
Foreman	—	—	85	5	2	8
Traffic manager	5	10	10	15	15	45
Development supt. ...	5	35	5	—	30	25
Operation supt.	5	15	10	25	10	35
Divisional traffic supt. ...	5	15	10	25	10	35
Permanentway engineer ..	5	10	35	10	5	35
Assistant p.w. engineer ...	5	5	30	20	5	35
Foreman	—	5	50	20	—	25
Manufacturing company.						
Managing director ...	40	15	5	—	5	35
Commercial manager ...	20	35	15	—	5	25
Manager traction dept.	—	40	20	10	5	25
Manager cent. stn. dept.	—	40	20	10	5	25
Manager supplies dept.	—	45	15	10	5	25
Manager lamp dept. ...	—	45	15	10	5	25
Chief engineer	5	10	40	5	5	35
Works manager	—	15	35	10	5	35
Foreman	—	—	65	10	5	20
Inspector	—	—	70	10	5	15

The competitors of Great Britain in the coming economic struggle will take care not to leave unutilised any weapon of economic warfare likely to prove of advantage to them. Clearly, under these circumstances, what will be wanted in the leaders in commerce and industry will be not only high imaginative power, but also the skill to secure "unity of purpose" in those under them by the direction of their efforts into the most effective channels; a scientific education and technical training of a suitable kind are as essential to them as to the engineer. A mere theoretical knowledge of science alone will do little to provide British industries with the class of men required to conduct technical enterprises with sufficient skill and in the spirit of progressive knowledge; the qualifications that are needed in the leaders of industry consist in a combination of high scientific attainments and proficient technical knowledge. Hence it is from the ranks of those engaged on the technical sides of the important industrial undertakings of the country that the selection should in the future be largely made of those who are to take supreme control of Great Britain's technical enterprises.

The question of the education and training of the engineer is closely associated with that of his status. Under present circumstances anyone may, without offending against the laws of the land, hold himself out to be an engineer, although he may never have made any study of engineering subjects; unqualified practitioners in engineering have brought discredit on the profession in the past, and will continue to do so until steps are taken to put a stop to their activities. The author is of opinion that the constitution of a General Engineering Council, possessing statutory powers analogous to those of the General Medical Council, would not only be of benefit to the engineering profession, but also of advantage to the public at large.

Discussion.

Mr. A. P. M. Fleming, O.B.E., in opening the discussion, said that the author had thrown new light on a very controversial subject. He thought the author had advocated the adoption of foreign practice without first duly considering the special characteristics of different peoples; what was good for one was not necessarily so for the other. He did not agree that technical instruction should be restricted, on the contrary, he thought it should be intensified. Special university training had the disadvantage that it did not allow of men rising from the ranks; it was desirable, in his opinion, that men should have the opportunity of so rising. Personally he preferred a general rather than a specialist engineer, he thought a man who knew something about several branches of engineering would be much more useful than a man who specialised in one and only one branch. With regard to practical training, he did not think the aim should be to impart special knowledge, it should rather serve to bring the student into contact with the many sides of his profession and familiarise him with a wide range of work. He objected to the premium system, it restricted apprenticeship to those who could pay, and the man who could not afford the necessary premium was out of it altogether; that was not as it should be.

Mr. R. S. Allen thought the author had made out a strong case for the broader training of the engineer. Out of every ten men trained under the present system, the tenth man would probably be the only lucky one to reach success at the completion of his training. In the speaker's opinion, the college course should not aim at teaching facts, but rather it should teach the student how to learn in after life. Book-keeping and accountancy came under the heading of mathematics, and, as such, should be taught at school before the student reached college. He noticed that in the paper no mention had been made of tact, that was a very strong point in administration, but unfortunately it could not be taught. The training of an engineer should be divided into two periods, first should come the works training, to be followed by the college course; the two periods being quite separate. He did not agree with either the author's or Mr. Fleming's views as to the payment of premiums. The training of a mechanic was entirely different from that of an engineer, and it was a mistake to try to equalise them. If a man desired to give his son a higher training, he should be able to do so by paying for it.

Dr. W. H. Eccles said that the author had made charges against the teachers which he did not think were justified. He directed attention to the move in the right direction which had already been made at Manchester connected with the training of engineers. In this country there was considerable hesitation before new procedures were adopted; it was often preferred to try new schemes on someone else first to see how they worked. He thought the reason why they were late in moving was that they were slow to appreciate the benefits that would accrue from the suggested innovations. The author had blamed the teachers for inertia, but he, the speaker, considered that conservatism mostly came from the other side. On the whole, the author had his entire support, the matter was a national one, and most urgent.

Prof. E. W. Marchant said that some of his points had been covered by the previous speaker, with whom he agreed, that conservatism came from the other side. In his opinion, the author had been much too hard on the professors. With regard to book-keeping, accountancy, and administration, he thought that these subjects could be much better taught at school before the student reached college. He thought that administrative ability would be highly developed in all those young men who had served in the Army; during their period of service such men had seen more of the world and its ways as well as of the handling of men than they would have done in double the time in the ordinary course of events. With the statement that students specialised too much in technology he did not agree; on the contrary, he thought they should specialise more than they did. It was

lamentable that in the past a large proportion of the designers in large firms had not been Englishmen, and he thought the colleges should see to it that that state of affairs was changed. He did not favour the educational "sandwich" system; as Dr. Eccles had said, it involved frequent interruptions to and changes over from one division to another of the training, which had a disturbing influence, and resulted in loss of time. In his opinion, the payment of premiums should be abolished; no student of the college with which he was connected had ever payed a premium. He thought the abolition of premiums would result in the best men getting the training, and not only those who could pay for it. He advocated more attention being paid to general education, especially during the last few years at school. Those years were very valuable; the impressions gained during those years had an important influence on the students' later college life.

Mr. A. P. TROTTER said that too much time in the college courses was given to the teaching of details; it frequently happened that almost before the design of a certain article was completed it could almost be considered to be out of date, something newer having appeared in the meanwhile. Therefore details should be left alone, and he thought a more general training would be found more useful. He noticed that nothing had been said about costing the paper; that was a most important subject, ignorance of which lead to very serious results. After all, the success of an engineer was to-day judged by the economic results achieved, and his training should be carried out accordingly.

Prof. G. W. O. HOWE explained that at the college with which he was connected, a course dealing with book-keeping and workshop accounting was given to all third-year students, and it had been found to be a valuable and most useful course. He said if they attempted to increase the number of hours at college they would get into difficulties. The engineering syllabus was overcrowded as it was, and new subjects were cropping up every day, each of which demanded its own line of instruction. Students spent no longer to-day over their training than they did twenty years ago, and yet they were supposed to know more. The real difficulty was to know what subjects to sacrifice in order to find the time in which to introduce new ones. There was a danger, he thought, in taking the syllabus of an American university at its face value; in the United States they gained breadth by sacrificing depth, which was a dangerous procedure. In his opinion, it was desirable to have depth rather than breadth.

Mr. J. S. HIGHFIELD paid tribute to the author for bringing up the subject. He thought that courses of instruction should deal more with broad principles rather than with details. A series of lectures on what the student ought to do when he left college would, in the speaker's opinion, be most valuable. The student would in that way be given some idea of what he would have to do, and he would be able to chose what to do. As a previous speaker had pointed out, the author had made no mention of tact, which was most important. Such things as the chosing of a staff could not be taught at college. Considerable anxiety had been expressed of late concerning the young men who were about to return to civil life after serving in the Forces. It was contended that these men had no training, and that they were older by several years than the age at which students usually entered college. In spite of all, the speaker did not think there was cause for anxiety, it was merely a case of the order of things having been reversed. Such young men had, during the term of their service, learned a good deal, which, in the ordinary course of events, they would have had to learn after they had left college. As a result, he did not think they ought to have any difficulty in acquiring the necessary technical knowledge in a comparatively short time, and he did not see why they should not be able to hold their own with men who had travelled the other way round—those who had gone to college first and then learned the ways of the world later.

Other speakers contended that the courses suggested in the paper were too short, and that what was being done in America must not be neglected. It was appreciated that British engineers were second to none, and it was therefore contended that professors had been teaching all along—though perhaps unconsciously—exactly what the paper was now advocating. The teaching of method and right thinking was emphasised, also that care should be exercised when changes, if any, were made. It was pointed out that students during their period of technical training often despised the commercial side of engineering, and it was urged that the tendency should be corrected. The importance of having a thorough command of the English language was dealt with, it being explained that it was necessary for an engineer to be able to convey to others his meaning exactly and clearly. It was very often a lack of command of the English language that led engineers into court.

The AUTHOR, in reserving his full reply to the discussion for publication in the *Journal* of the Institution, said that in writing any paper much was necessarily based on personal experience, and he had found that in foreign countries the commercial qualifications of engineers were appreciated, and given much more consideration than in this country. He did not advocate the making of engineers into specialists, he wished sign-posts to be erected to point out the quickest way to the necessary knowledge.

THE SUPPLY OF SINGLE-PHASE POWER FROM THREE-PHASE SYSTEMS.

THE paper by PROF. MILES WALKER was read and discussed at the North-Western Territorial Centre of the INSTITUTION OF ELECTRICAL ENGINEERS on January 28th. An abstract of the paper appeared in the ELECTRICAL REVIEW of December 13th, and 20th, 1918.

Mr. AYRES said that static condensers had been very much improved in recent years, and at a reasonable cost, if not of a reasonable bulk, they could be produced quite satisfactorily. But one trouble was that the static condenser was not flexible except with a large amount of switch gear. It was pointed out in the paper that if one had a static condenser to correct the balancing of the phases, when the unbalanced load was thrown off, the static condenser (being unbalanced in the opposite direction) made the phases just as unbalanced as they would be without the correction with the unbalanced load on in the opposite direction. That was rather a serious proposition. If one had more than one furnace and used static condensers, it would mean either a good deal of continuous switching in and out or else the load would be continually balanced and unbalanced in various directions. A consulting colliery engineer who had had static condensers to correct the power factor of the feeders in his mine proposed to throw them out and put in synchronous rotating machinery to do the same work. With regard to electric furnace work, one of the limiting features was the amount of power one could use per carbon electrode. At present the limiting size to which the electrode could be made was something like 16 in. or 18 in. square for the compressed coke electrodes, and 12 in. for the graphitic. This meant that at the ordinary voltages of about 500 one could use about 400 KW. per electrode. If the single-phase furnace with a single electrode was adopted, it seemed to him that they were going in for rather small furnaces, and the other furnaces using 3, 4, 6, or 8 electrodes would stand a better chance—where very considerable powers could be used in one furnace. For a small furnace like this, with double the voltage, they could go up to perhaps 800 KW. It would be used chiefly, he supposed, for refining purposes, and that not on a very large scale. If, then, they were going to be limited to furnaces of 400 to 800 KW. capacity he did not know whether a machine of this construction was going to be of any great advantage.

Mr. CHADWICK described a method of balancing with series transformers and a synchronous motor.

Mr. SCHAFFER suggested that by using a synchronous motor instead of a condenser, and by over-exciting it, the necessary balancing effect would be produced automatically, without the use of intricate switchgear.

Mr. STOCK said the question was discussed a few months ago whether the single-phase system would be useful in large units, the idea being that the electrode would largely control the amount of current which could be put into the furnace. That was perfectly correct, but in the system which Mr. Snyder had introduced to the steel-making world a rather high voltage was used which enabled them to carry quite a large amount of power in a single electrode. He did not think that at present there was any reason why the furnace should not be built to use, say, 2,500 KW., which would approximately mean about 15 tons capacity. He held that any furnace which would work at all would make equally good steel, and entirely disagreed with any claim that either polyphase or single-phase furnaces would make better qualities of steel than the other. If that were the case, it was obvious that the steel maker had to look to economy as the only guide for the selection of a furnace. Economy could be brought about in three directions. First of all the condition that the steel maker looked for was a fairly economical power consumption. Secondly, he examined his electrode consumption. Thirdly, there was the cost of maintaining the linings. Apart from those things he did not see that there was very much to consider in any type of furnace. In the arc type of furnace the obvious position to introduce the heat was in the centre of the furnace, because as the heat travelled towards the outside, it was absorbed as much as possible by the charge in the furnace. For that reason Mr. Snyder—and he agreed with him—was a believer in the single-phase system. The second point was the electrode consumption. It was quite obvious that if they could reduce the number of square inches of electrode exposed to the gases in the furnace they reduced the diameter of it. The electrode consumption was governed by the amount of oxidation which took place in the furnace itself, and this principally occurred during the time of charging. He believed it could be shown that the volatilisation of the carbon in an electric furnace ran about 1 lb. of electrode per ton of metal. Experiments carried out in single-phase work had shown that it was quite possible to operate a single-phase furnace of 400 KW. capacity making, say, 50 to 55 tons of metal per week with an electrode consumption under 0.6 lb. per ton of metal produced. The normal electrode cost a shilling a lb. This was undoubtedly an item which had to be considered in choosing the type of furnace. The life of the lining was entirely dependent upon the control which they had over the consuming power of the furnace. Given proper control there was no doubt that the linings could be made

to stand up for quite a respectable period. They had at present four furnaces operating at Bradford, and were able to produce at least 200 tons of steel a week, working for a week without any repair whatever. These results had produced a very good load factor on the furnace. The method they used for judging the load factor was to take a full week of seven days, multiply the hours by 400 KW., and divide that by the number of units used to produce the steel during the week, 53 tons multiplied by 700 units. That gave a load factor somewhere about 6 per cent. Those were the only considerations which he thought one would be justified in regarding in the choice of an electric furnace. One objection which had been raised in this country to the Snyder furnace or the single-phase furnace when refining was the object of its operation. With furnaces of this type the theoretical considerations which governed the desulphurising of the steel were these. It was necessary to produce a melt which was entirely deoxidised and had pure lime slag above it. To achieve this condition they must have a very high temperature, and if, as would occur with the Snyder type of furnace, they were to carry out the refining operations with the full voltage, that was at 160-volts pressure, they would very soon find that the arc became drawn out, possibly to the extent of 18 or 24 inches. The drawing-out of the arc must naturally throw the heat from it in the direction of the roof, and the furnace would burn down and spoil the refining operations. It had been found necessary in refining operations to work with an arc of not more than 80 volts pressure to prevent this pulling out, and to concentrate the generation of heat on the slag itself. To arrive at this result Dr. Walker had given them a separate drop, which allowed them to drop the voltage down to his figure, and to maintain a sufficient impedance to keep the material hot, and under these conditions refining was a perfectly feasible operation.

Mr. Bolton Shaw believed that in America the single-phase furnace was a very attractive proposition, from the consumer's point of view. The diminished consumption of electrode, and the lessened cost of lining, were points in its favour. From the central-station engineer's point of view it was certainly not very attractive, but in America, where the Snyder furnace had been installed to a considerable extent, the large power companies did not object to put in furnaces to use single-phase with a three-phase set. In this country at the introduction of the single-phase furnace an objection was raised to having it put upon the supply system without any method of balancing, and a sort of compromise was adopted. Two single-phase furnaces were put down with transformers, and that gave a certain amount of balancing. In most cases a charge was made per KW.-hour plus a charge for maximum K.V.A. It was easy to see that if the furnace gave a considerable reactance the maximum K.V.A. would be a very high figure. The cost on the K.V.A. charge was considerably higher. In the case of the balancing of a number of furnaces working day and night the K.V.A. charge was less in proportion to the total charges, and did not offer the advantages that it did in the case of an installation where the load was intermittent. In the small power stations the question of balancing was very important. The central-station engineer would certainly object to have a single-phase furnace put directly on to his mains without any question of balancing. It did say a great deal for a machine if it could do this satisfactorily.

Mr. Angus said that Professor Walker in particular, and some other writers of papers, very often provided them with new viewpoints. For instance, he had a large amount of business to do with the undeveloped countries of South America, particularly Bolivia. In those countries, if they had been able to get hold of a machine of this sort they would have been able to do something which was most difficult to do, especially during the war. They had not been able to get hold of any machinery from England, and the consequence was that Japanese and American machinery had been pouring into the country. In Bolivia the circumstances they came up against were quite different to what one met in this country. For instance, cost did not matter very much, because the transport costs were generally three or four times the cost of the plant; the main consideration was whether they could do the work, and they generally could do it with electrical machinery where they could not do it with anything else. He would like to hear more of a practical nature from people who had been using static condensers and synchronous motors as correcting and balancing machines. There had been two cases just recently where they could have used them perfectly. Bolivia was a country which was at an altitude of something like three miles, and the Diesel gas engine was the only prime mover they could get hold of. Coal cost a tremendous amount—even before the war it went up to about £25 a ton—and the only other fuel was a resinous moss which grew on the mountain side, and was mostly exhausted. They used water power when they could get it, but it was generally not of much value, because it was so far distant, and in such remote regions that they could not run transmission lines. They put up a Diesel engine of about 450 H.P. (sea-level rating), coupled to a three-phase alternator for mining work. The engine, of course, was only able to give about 250 H.P. at that altitude, and they had put in an alternator that would develop the whole of the power of that engine at that altitude. Then they had a complaint from the owner of the mine saying the engine was much too big for the rating. He had three-phase induction motors, and could not get more load on because he had already chosen them far too large, and always got a low power factor. The trouble was that the low power factor simply swamped the alternator, and so he said, "I can do the whole of the work with two cylinders, but what is the good of giving me an alternator that will not do that?" If they could have got hold of a static condenser, or a machine of that sort, they would have been able to alter the position altogether. They had had that sort of trouble on more than one occasion out there. He asked the engineers of this country to pay a little more attention to these new fields in the export world. There were very few manufacturers in this country who realised that there were huge fields abroad which at present they did not touch. The only enterprising people here seemed to be the cotton manufacturers; they were the only people who sent out representatives to travel in those countries. During the war they had been swamped with Americans in person; with Japanese in person; they had the Germans always with them; but they had never had a single English firm which had been about business in Peru, Chile, or Bolivia. He would like people in that room to pay a little more attention to these countries, because now was the time. This matter should interest the suppliers of machinery, who seemed to get the idea that the only rules they had to fulfil were the voltage rules of this country. The reason why the Germans did so well in these countries was because their machinery was not designed for their own trade, but for their export trade. He had had the greatest difficulty in getting British manufacturers to alter their designs or modify them in some way or other to enable him to sell them. He could not sell them merely because they were suitable for British mines; the circumstances were quite different.

Dr. Cramp did not understand why Dr. Walker had ruled out a rotating balancing transformer with one winding, taking in the three-phase power into one winding and giving out single-phase power from the same winding, and then transforming down that single-phase power by means of a single-phase transformer, and balancing by means similar to those which Prof. Walker himself employed. There did not seem to be any reason why that type of machine should not work quite as well as the proposal put forward, and it would be a good deal cheaper to set at work. Possibly it would be cheaper to build. The author showed that there was a great advantage in having only two electrodes instead of three, but the disadvantage which Prof. Walker pointed out of a breakdown across the roof, due to the fact that there was a potential difference between the pair of carbons situated there was offset to a certain extent by the ease with which the furnace could be started. He was told by the users of these furnaces that in the future the furnace was going to be used much more for refining than for melting; and if that were so the advantages of high voltage very largely disappeared. They could easily deal with 15 tons with 2,000 KW. with a three-phase furnace. The power-station engineers with whom he had had to deal in connection with these furnaces had complained not about the large fluctuations of power, but about the large fluctuations of current, if the current was more or less wattless. It would be seen that according to the author's fig. 23 the current might vary from nothing to 4,000 amperes although the power varied very much less; so from the point of view of the power-station engineer it would seem that a constant-current machine would be more valuable than a constant-power machine for this class. Professor Walker said that automatic regulators were not found to be sufficient during the first twenty minutes after the furnace had been started up from cold, and it was sometimes necessary to have three operators (one at the regulating wheel of each carbon) with their eyes fixed on the ammeter, to screw up and down the carbons every few seconds in order to keep the currents approximately balanced. Evidently the author of the paper had not seen the regulator that had been recently introduced to cover that very point, by means of which, on the carbon being lifted out, the furnace circuit was closed, and the furnace was left absolutely to itself, and the carbons came down gradually on to the material. The only condition under which that regulator was not very satisfactory was in connection with new carbons; if they were treated in that way new carbons were apt to split the first time they were heated.

Professor Walker, in reply, said that in the actual performance of the machine not much depended upon the little leakages across the slots. The main portion of the leakage occurred between the narrow places which were only 5 cm. long. The main point that he wanted to make in connection with the Snyder arrangement of the reactance was obtaining stability. Upon that the integrity of the lining depended. When they introduced the balancer they got not only a small input of power but also a small input of current. There was no reason why they should not have a single-phase furnace with as many carbons as they liked. They might take six carbons and have a furnace occupying a large amount of floor space. The starting was done by an electrode at the bottom. There was no difficulty in starting, whether it were a silica and acid lining or a basic lining. Furnaces were used both for melting and for refining. In all the electric furnaces in this country that he had seen they did their melting first, and then their refining. The melting furnace was the one which took the power, therefore it was a very great advantage to be able to melt at a high voltage.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Battery Charging Equipment.

The attention now being given to electric vehicles and their growing popularity make the contents of a new leaflet (No. 780) issued by the Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, of interest, dealing as it does with electric-vehicle battery-charging equipment.

The universal, unit type, charging panels (fig. 1) with self-contained rheostats consist of a number of unit sections (fig. 2) assembled in frames. The sections are only 24 in. wide by 10 in. high by 20 in. deep. Installation is easy and additions can be made at any time. The panels are designed for use on both two-wire and three-wire circuits, and the unit construction permits of meeting special requirements. A charging section (fig. 2) carries the rheostat contacts and sliding brush; a low current circuit-breaker at the left-hand side; an instrument switch, at the right; a pilot lamp, and a grid type resistance, which is mounted on the back. Two standard fronts are made, one having a maximum rating of 90 amperes and the other 180 amperes. For the 90-ampere front renewable button contacts and shoe contact brush are provided. For the 180-ampere front the sliding brush is of laminated copper and renewable contact segments or plates are used instead of buttons. The sliding brush supported by a guide rod moves smoothly over the contacts.

Each rheostat section with its resistance is a complete unit in itself. It is attached by bolts to the frame, and after disconnecting from the bus-bar can be readily removed if these bolts are taken out. The low current circuit-breaker mounted at the left has a laminated brush main contact and auxiliary arcing points. It is interlocked with the rheostat so that it cannot be closed except when the sliding brush is moved to the position of "all resistance in." It can then be closed, and a small magnet in series with the charging circuit holds it in this position unless the charging voltage falls to a value less than the battery voltage or in case the service fuses should be blown, when it acts as a line switch. The instrument switch is a three-position switch, having "open," "closed," and "reading" positions. When in the "open" position the circuit to the battery is broken; moving to the "closed" position completes this circuit—and when in the "reading" position the meter, mounted on a swinging bracket, is connected to the battery

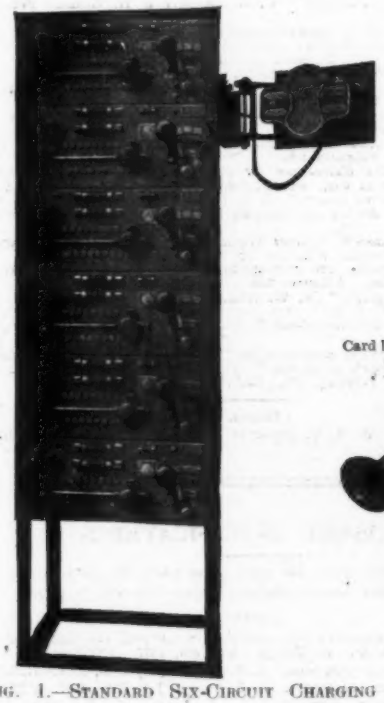

Fig. 1.—Standard Six-Circuit Charging Board.

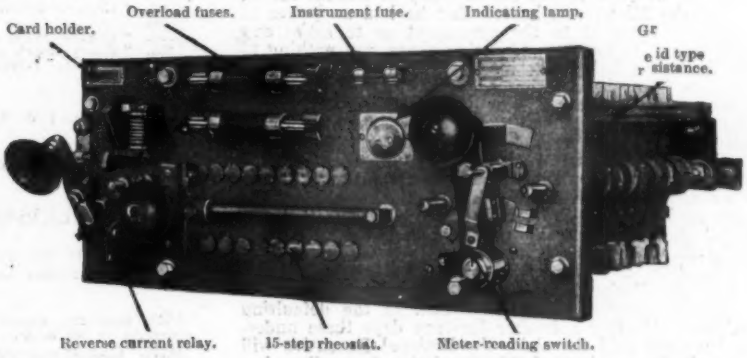

Fig. 2.—90-Ampere Charging Section.

circuit indicating the voltage of the battery. If the low-current circuit-breaker is closed, the current is also indicated on the ammeter scale of the instrument. With regard to the operation, assume that all switches are open, the rheostat slider moved to the left-hand position and the battery connected to one of the charging circuits. This will be indicated by the lighting of the pilot lamp. The instrument switch can then be moved to the reading position, and this will show the voltage of the battery on the voltmeter, and if the battery leads are not properly connected, this fact will be apparent by the deflection of the needle in the reverse direction or off the scale. Assuming that the connections are properly made, the low-current circuit breaker should then be closed and the rheostat slider moved forward, increasing the charging current until the derived amperage is obtained as indicated on the ammeter. The instrument switch should then be released, when its spring will move it back to the "closed" position, thus allowing the charge to continue, but disconnecting the instruments from the circuit. The line and battery connections are all at the back, on the outside of the frame, making the installation work very easy, and as the apparatus is all self-contained, there is no assembling and rheostat wiring to be done on the job.

Vacuum Sweeper for Textile Mills.

The portable broomless floor sweeper illustrated herewith (fig. 3), which is specially designed for use in textile mills, is manufactured by Mr. William Firth, 200, Devonshire Street, Boston, Mass., U.S.A. The motor is driven by an Edison B-6, 9-cell storage battery, which will continue to operate the sweeper at normal constant speed for eight or nine hours without recharging. The motor, which is of ½ h.p., is directly connected to a specially-designed fan,

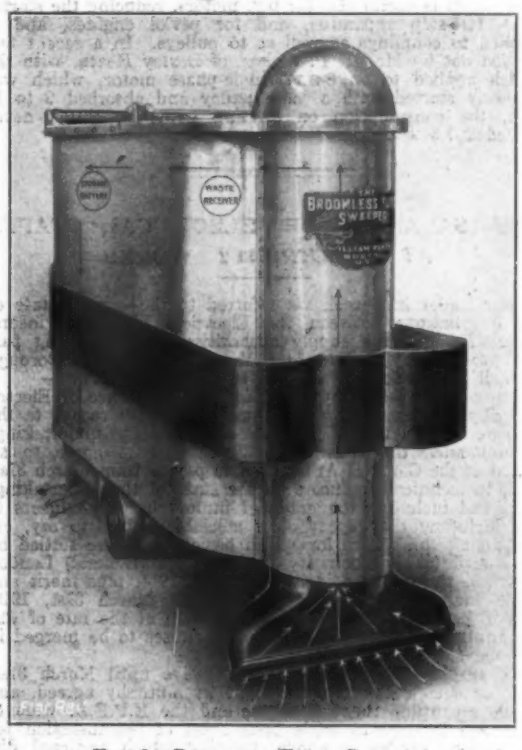

Fig. 3.—Broomless Floor Sweeper.

which creates a suction that picks up the sweepings and delivers them to the waste receiver. When desired, the discharging air current can be deflected to either side of the machine, and can be regulated to force the sweepings from under machinery into alleys, where they can be reached by the machine. Where this method is not desirable, a flexible tube and special vacuum sweeping nozzle can be supplied, which reaches under the machinery and removes the waste by suction.

Woodhouse Automatic Clutches.

Owing to the war, the progress of the Woodhouse automatic clutch, which we described in our issue of November 3rd, 1916, has been much hampered, but the difficulties have now been overcome, and Messrs. Woodhouse & Co., of Sanctuary House, 33, Tothill Street, S.W.1, have standardised a series of sizes from ¼ to 80 h.p., at speeds from 400 to 2,700 r.p.m. Special sizes are also made, and the largest so far put in service being rated at 500 h.p. These clutches are now built wholly inside the pulleys, in a greatly improved form, and are extremely simple in design; their special virtue is that they leave the motor entirely free of load up to a definite predetermined and adjustable speed, and then take up the load smoothly and without shock, the drive being purely by friction. Some of them, we understand, have been in use for over four years, and have never required renewals, the wear being negligible. Obviously they are particularly suitable for starting squirrel-cage motors, single-phase or polyphase, and they have the advantage that the rush of current at starting is minimised, and the starter may be of the simplest and most inexpensive type—the motor may, in fact, be switched direct on the mains up to at least 10 h.p.—so that the extra cost of a slip-ring motor and ordinary starter is eliminated. There is no risk of damage through careless starting, the rate of taking up the load being dependent only on the load, and independent of the operator. The clutch is useful also for d.c. motors, reducing the starter to a two-step apparatus, and for petrol engines, and is applied to couplings as well as to pulleys. In a recent test carried out by Mr. H. P. Stokes, of Bexley Heath, with the clutch applied to an 8-h.p. single-phase motor, which was formerly started with a loose pulley and absorbed 9 to 10 kw., the consumption on starting with the clutch never exceeded 7.6 kw.

THE SALARIES OF ELECTRICAL STAFFS AT ELECTRICITY WORKS.

In our leader last week we referred to the critical state of the negotiations between the Electrical Power Engineers' Association and the supply authorities. The following particulars, which were before the Hammersmith Borough Council last week, will serve to explain the allusion :—

A resolution passed by the Standing Conference of Electricity Supply Associations on January 8th, with regard to the salaries of the technical staffs of electricity undertakings recommended the constituent associations to agree to an award of the Court of Arbitration to pay as from March 31st, 1918, to technical engineers on the staffs of the undertakings from and including the grade of junior charge engineers to and including the deputy chief officials (that is to say, excluding all the grades for which basic rates were settled by the award (2772) Electricity Undertakings (General) London District), the salary paid at July 31st, 1914, plus merit and grade increases between that date and March 31st, 1918, plus 20 per cent., plus an additional sum at the rate of £90 per annum, war advances and war bonuses to be merged in the above.

This arrangement was to be operative until March 31st, 1919, or such other date as might be mutually agreed, and in the meantime the Conference and the E.P.E.A. were to meet and proceed to settle basic rates of remuneration for the various grades as above, pending which sectional discussions as to basic rates were to be adjourned.

The matter was referred to the Ministry of Labour for an award, but the Minister intimated that he had no power to give statutory approval to the agreement or to make any order extending it; but he added that there was nothing to prevent the grant being put into operation by the parties concerned as from the date agreed upon.

The Incorporated Association of Electric Power Companies had definitely undertaken to make the payments of the amounts recommended at the Conference, and the Incorporated Municipal Electrical Association representatives had decided that all their members also should make the payments as recommended, forthwith. In the meantime the following notice had been served by the Electrical Power Engineers' Association upon the Standing Conference of Electricity Supply Associations, viz. :—

"If the claim is not paid or agreed to be paid within seven days the National Executive Council have decided to bring out the members of the E.P.E.A. in the defaulting undertakings. If after a further fourteen days these undertakings have not paid the claim the National Executive will bring out all the members of this association from all undertakings in support of the men in those undertakings which refuse to pay or have not paid."

A circular letter from the Standing Conference dated January 31st, 1919, urged that, having regard to the emergency of the matter and its vital importance to the electricity supply industry, the claim should be accepted by all electricity supply undertakings within seven days, and inquired whether, in the event of the council being unwilling, for any reason, to pay the claim forthwith, it would agree to submit the matter to arbitration, the arbitrator being appointed by the Minister of Labour.

The total present wages, with bonus, of the members of the staff affected, including also the increase recommended in the resolution of the Standing Conference, were as follows :—

Ordinary wages.	Present bonus.	Total present wages.	Proposed bonus.	Total proposed wages.	Increase.
£	£	£	£	£	£
400	133	533	170	570	37
350	127	477	160	510	33
200	108	308	130	330	22
175	74	249	125	300	51
164	74	238	123	287	49

To those who have not yet returned from war service, the increased rates will only be payable as from the date of their return. The Electricity Committee and the Salaries and Wages Committee recommended that the resolution of the Standing Conference should be adopted by the council.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

43. "Electric accumulators." W. A. T. Furst. January 2nd.
1,960. "Magneto motor." D. Suchostawer. January 27th.
1,971. "Electric clock." A. G. Wallis & N. Collins. January 27th.
1,976. "Electric and gas lamps or lanterns." F. W. Ball & J. Y. Fletcher. January 27th.
1,984. "Means for suspending conductor wires on electric railways, &c." P. Dawson & F. W. Fawdry. January 27th.
1,985. "Supporting device for overhead electric trolley wires." P. Dawson & F. W. Fawdry. January 27th.
1,986. "Means for suspending trolley wires of electric railways, &c." Dawson & F. W. Fawdry. January 27th.
1,991. "Electrical connections." H. Garde & C. G. Bennett. January 27th.
2,015. "Relays for alternating or intermittent currents." C. V. Drysdale. January 27th.
2,020. "Intercommunication telephone systems." L. C. Bygrave. January 28th.
2,038. "Magneto-electric machines." G. M. Turner. January 28th.
2,052. "Attachment to flexible connections to telephone receiver and transmitter." M. Barthropp. January 28th.
2,053. "Electric lamps for vehicles." Fuller Accumulator Co. & A. P. Welch. January 28th.
2,601. "Process for building up or growing iron upon steel, &c., surfaces." S. O. Cowper-Coles. February 3rd.
2,602. "Electrolyte for deposition of iron." S. O. Cowper-Coles. February 3rd.
2,626. "Sparking plugs." J. E. Barrows. February 3rd.
2,644. "Electrical phase-converting systems." British Westinghouse Electric & Manufacturing Co. February 3rd. (U.S.A., March 14th, 1918.)
2,649. "Electric lampholders." J. T. Jennens and Morum & Co. February 3rd
2,654. "Electric lampholders." C. G. Bennett & H. Garde. February 3rd.
2,656. "Electromagnetic signalling apparatus." A. Baguti. February 3rd.
2,663. "Railway electric track circuit systems." W. R. Sykes Interlocking Signal Co. & R. W. Tarrant. February 3rd.
2,672. "Electric bells." F. J. Shenton. February 3rd.
2,681. "Electrical apparatus for preventing burglarious acts, &c." P. B. Metchim. February 3rd.
2,693. "Electric dining-table fitment and indicator and recorder." S. W. Parker. February 4th.
2,710. "Terminal electrical connections for sparking plugs." C. F. Burton & H. Burton. February 4th.
2,742. "High-tension distributors for electric ignition apparatus." Akt. Ges. Brown, Boveri et Cie. February 4th. (Germany, February 4th, 1918.)
2,751. "Electric wave meters." J. S. E. Townsend. February 4th.
2,761. "Tools for slotting commutators, &c." J. Gardner & C. Y. Knight. February 4th.
2,785. "Electric fuses." British Westinghouse Electric & Manufacturing Co. & W. A. Coates. February 5th.
2,786. "Electric clocks, and contacts for same." R. C. Halford, W. J. Halford & F. T. Reid. February 5th.
2,793. "Sparking plugs." F. W. Hill. February 5th.
2,816. "Holders for electric lamp shades." H. Ward. February 5th.
2,821. "Magnetos for internal-combustion engines." L. J. Stokes. February 5th.
2,833. "Dynamo-electric machines, &c." W. G. Ivamy. February 5th.
2,835. "Rotary electric converters." British Westinghouse Electric and Manufacturing Co. February 5th. (U.S.A., March 13th, 1918.)

Errata.

Delete entry under W. A. T. Twist in the issue of January 17th, 1919.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

6,344. Electrical apparatus for detecting, measuring, and indicating the derivation of boreholes. H. Briggs. May 4th, 1917. (122,204.)
10,778. Electric heat radiators. A. F. Berry. July 26th, 1917. (122,206.)
10,779. Electric heat radiators. A. F. Berry. July 26th, 1917. (122,207.)
14,685. Electric heat radiators. A. F. Berry. October 10th, 1917. (122,210.)
16,738. Method of and apparatus for heating by electric induction. Ajax Metal Co. November 25th, 1917. (111,844.)
18,976. Electrical cables or conductors. A. V. L. Hubert & G. E. Turnbull. December 21st, 1917. (122,219.)

1918.

684. Circuit arrangements for operating the selecting devices of telephone installations by number impulses. T. Pettigrew. January 11th, 1918. (122,235.)
757. Electrical transformers and the like. A. Schanning. January 12th, 1918. (122,238.)